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INFORMATION PRESENTATIONS FOR DISTRIBUTED DECISION MAKING:

OBSERVATIONS AT THE NAVAL WAR COLLEGE

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This report describes research at the Naval War College in which a psychology theory was applied to information presentations potentially able to support distributed decision making in the Naval Battle Group. The psychology theory describes how information used by experienced decision makers is encoded in memory and used for situation interpretation, decision making, and problem solving. The information presentations represent plans. They are intended to support distributed decision making by helping all decision makers have a better and more uniform understanding of the plan, by helping them be alert to critical tactical conditions that bear on the continued viability of the plan, and by reminding them of the different responsibilities and tasks of all Battle Group decision makers.

There were several noteworthy accomplishments of this effort. It was possible to

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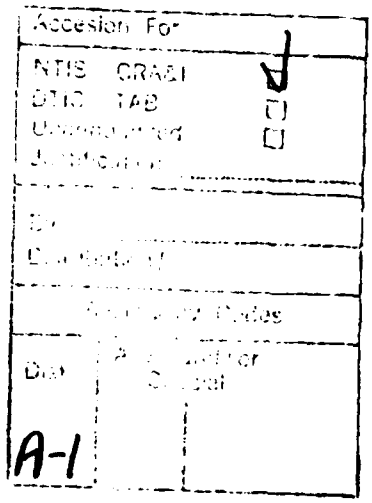
apply information presentation principles developed from the psychology theory to charts representing war games plans at the Naval War College. These charts proved easy to understand and useful for eliciting plan information. In addition, the charts were sufficiently flexible to be updated as the plan was executed, and consequently could be used to represent the progress of the plan in meeting mission objectives. The war game participants generally commented favorably on the chart, suggesting that such presentations, if integrated into the Battle Group tactical information system, might contribute to military effectiveness by aiding planning and plan supervision.

Contrary to expectation, no example of poor coordination caused by differing situation assessments among decision makers was observed in the monitored war games.



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1. INTRODUCTION AND EXECUTIVE SUMMARY

1.1. Background

This report describes research in distributed decision making conducted at the Naval War College in Newport, R. I. in February 1988. This research investigated a new type of information presentation intended to improve coordination among the warfare commanders in a Naval Battle Group.

The foundation for this work is a theory of information presentation for distributed decision making developed by Engineering Research Associates under ONR's Distributed Tactical Decision Making program. This theory has three components, one about coordination, the second about expert decision making, and the third about the internal representation of knowledge in memory.

The first component concerns the importance of a shared situation assessment to coordination among a group of spatially distributed decision makers, each with a different area of responsibility, each controlling different assets, yet all working from a common plan toward a common goal. It is proposed that if all decision makers interpret situation data similarly and reach similar conclusions about the significance of the situation to actions specified by the plan, then coordination will be better than if the decision makers interpret situation data differently. It is further assumed that providing all decision makers with the same situation data will not by itself ensure uniform interpretations, for people with different backgrounds and responsibilities can reach different conclusions from the same data.

The second component focuses on the role of situation assessment in individual decision making. It proposes that situation assessment is especially important for experienced decision makers, for experience allows many decisions to follow almost directly from a situation assessment. In this kind of "recognition-based" decision making, the decision maker takes a particular course of action because "that kind of action" usually works well in "this kind of situation".

The third component, a theoretical model of human cognition, addresses the relationship between information presentation and situation assessment. The theory assumes that when a decision maker decides that a particular observed situation is "this kind of situation", he is comparing the observed situation with a collection of reference situations retrieved from his memory. The theory of information presentation assumes further that if the internal representation of these retrieved reference situations could be understood and described, then this internal representation could guide the design of information presentations which are easier to understand, better able to support decision making, and better able to facilitate communication among decision makers.

These three components support one another in the overall theory of information presentation for distributed decision making. The description of the internal representation of knowledge leads to information displays that support a more accurate and more uniform interpretation of the situation among decision makers. When decision making is

"recognition-based", as the theory assumes is often the case for experienced decision makers, this more uniform situation interpretation leads to more compatible decisions among distributed decision makers, and thus to improved coordination.

Over the past three years, Engineering Research Associates, as a participant in the Office of Naval Research program in Distributed Tactical Decision Making, performed research on the second and third components of the theory: the internal representation of knowledge in judgment and situation assessment (Noble and Truelove, 1985; Noble, Boehm-Davis, and Grosz, 1986) and the role of situation assessment in recognition-based decision making (Noble, Boehm-Davis, and Grosz, 1987). This research suggested general principals of information presentation to support recognition-based decision making.

The research at the Naval War College was a first effort to apply these principles to information presentations able to support military decision makers in a relatively unstructured war game environment. This work examined whether it would be possible to apply abstract principles to complicated concrete problems.

1.2. Overview of War College experiments

During the year preceding the experiments, ERA met with Naval War College faculty to better understand Navy doctrine for planning and plan supervision, and to identify areas that could benefit from new information presentations able to support coordination through improved situation understanding (Noble and Mullen, 1988). ERA was extremely fortunate to be advised by Mr. Frank Snyder (Capt. USN, ret.) the faculty member responsible for Command and Control instruction at the Naval War College.

As a result of these discussions, ERA decided to focus on a single chart able to represent the Battle Group plans. This chart was guided by the theory of internal knowledge representation and by Navy planning doctrine. It is intended to capture those essential features of a plan which are needed to help Battle Group decision makers to understand their plan and determine during its execution whether it will still enable the Battle Group to achieve its mission objectives.

Principal conclusions and results of the observations at the Naval War College were:

1. It is possible to represent the actual plans developed by the war game participants in the format of the theory-based plan representation chart. This success suggests that it may be possible to develop more general formalisms for decision aid design. This theory-based approach to decision aiding has been advocated often in the past. In actual practice decision aid designers have made very little use of models of human cognition (Cohen, 1987) either because the designers were not aware of such principles or because the principles could not be applied to a concrete problem.

2. Plans so represented were easily understood, and were felt to capture essential elements of the plan needed to support plan supervision.

3. The charts seemed to be useful for reducing differences in plan understanding among decision makers.

4. These plan representation charts can be updated during mission execution, and thus convey the progress of the plan toward plan objectives. Because unexpected events often arise during the mission, plans can rarely be carried out exactly as expected. The plan representation chart seemed robust enough to accommodate these numerous relatively minor unexpected events.

5. War game participants felt that these displays, if integrated into the command and control system, may improve the decision making and coordination in the Battle Group.

6. In the war games observed there were two examples of poor coordination. In neither case could the coordination failure be attributed solely to different opinions about possible hostile objectives or estimated future course of action. In one of the cases, however, the coordination failure arose because two different decision makers assessed differently the significance of the situation to actions specified by the plan.

7. It was not possible in these preliminary experiments to demonstrate whether the plan representation chart leads to better decisions, better coordination, or better mission outcomes. Although it would be very desirable to test these issues, doing so would be very difficult in the unstructured war game environment. Because the purpose of the game is instruction, actions taken by the instructional staff for educational purposes, as well as decisions by war game participants, influence the war game outcome. Consequently, the connection between the quality of student decisions and war game outcome is often weak.

1.3. Report organization

This report has six additional sections. The following section describes the plan representation chart. Section 3 describes Navy doctrine for planning and plan supervision, and reviews the theory of information presentation for distributed decision making. This section outlines the theory-motivated design principles for information presentation and relates them to the plan representation chart. Section 4 describes the current war game environment and the war game scenario. Section 5 presents the results. It contains one of the plan representation charts actually developed, discusses the use of this chart to uncover different possible understandings of the plan among decision makers, describes how the chart was updated during the war game, reviews examples of poor distributed decision making, and reviews general comments that war game participants made about the chart. Section 6 discusses unresolved theoretical issues raises by this work and describes how the chart can be used in operational aids for planning and plan supervision. Appendices A and B are the Commander's Estimates and Operations Orders prepared by Seminar #7 at the Naval War College.

2. PLAN REPRESENTATION CHART

2.1. Purposes of chart

Plan representation charts summarize a war plan. They are intended to support coordination among decision makers by decreasing differences in plan interpretation, by increasing agreement on the progress of the plan, by increasing agreement on needed revisions during plan execution, and by helping decision makers consider alternative possible Enemy Courses of Action (ECA).

To support distributed decision making, separate charts are created for each decision maker. Because these commanders have different responsibilities and consequently may focus on somewhat different aspects of the plan, the plan representation chart developed for each Warfare Area Commanders may differ slightly. Differences between charts are minor, however. The overall format and organization of the chart is the same for all commanders.

2.2. Overview

A plan specifies actions to be taken to attain mission goals. An overall plan may include several alternative plans. Each of these alternatives is associated with a particular set of plan assumptions which determine conditions under which it is to be executed. A plan representation chart reflects essential features of one of these alternative plans. Ideally, a separate chart would be prepared for each alternative plan developed in the planning process.

Figure 2-1 shows the overall organization of the chart. The chart is divided vertically into three main sections. The uppermost part specifies mission objectives. The middle part of the chart specifies plan assumptions, showing all relevant assumptions about possible enemy courses of action and environmental factors. The lowermost part of the chart depicts the directive. It shows the force organizational elements and the plan tasks assigned to each of these elements.

The plan chart is divided horizontally into two sections. The left section contains row labels. The right section depicts temporal relationships between designated tasks, plan assumptions, and plan objectives. Time increases along the horizontal axis in this part of the chart. Horizontal subdivisions in this right section represent different phases of the plan.

Figures 2-2 and 2-3 illustrate portions of the actual charts created to represent the plan of Seminar #7 in the War College Command and Control course. The complete plan is shown in section 5. Figure 2-2 shows the objectives and assumptions sections of the chart for the entire mission. Figure 2-3 illustrates the directive section, along with a summary of the assumptions section, for the first part of the mission.

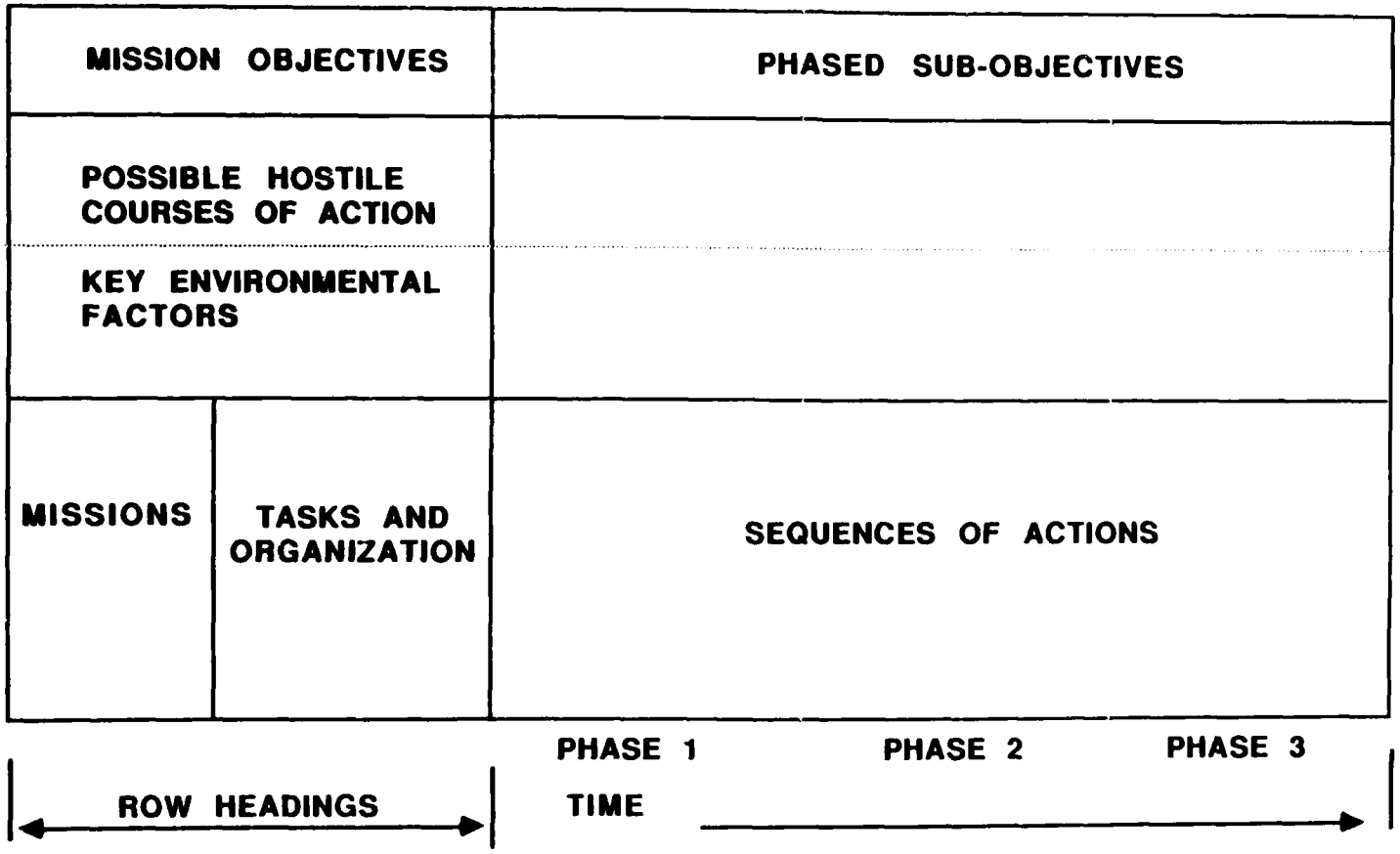


Figure 2-1. Overall organization of the plan representation chart.

2.3. Mission objectives section

Mission objectives are represented by sub-objectives selected to attain mission goals. In the chart, sub-objectives to be attained sequentially are displayed in series at the top of the chart. Sequentially addressed sub-objectives define the major phases of the mission. Sub-objectives to be attained simultaneously are drawn above and below each other. In Figure 2-2 the objectives "Protect ARG / TG 70.5" and "Protect MPS / Diego Garcia" are addressed simultaneously. The sub-objectives "Destroy Intel Platforms", "Attack SAG", and "Attack Land Facilities" are to be accomplished sequentially.

The depiction of mission objectives is intended to support both planning and plan execution. During planning this depiction may help planners organize their plan around objectives. During execution of the plan, when decision makers are evaluating whether the planned actions still enable mission objectives to be accomplished, displaying objectives may help them focus on the accomplishment of objectives rather than just on the completion of assigned tasks when considering the need for plan changes.

2.4. Assumptions Section

Plan assumptions are those suppositions about events relevant to deciding at the time of plan execution which alternative plan to exercise. The assumptions section on each plan representation chart lists all suppositions relevant to selecting any of the alternative plans, and highlights those assumed to hold for the particular plan displayed on that plan representation chart.

Displaying assumptions is hypothesized to be useful both when the plan is being formulated and also when it is being executed. During planning it helps planners to consider a range of alternative possible enemy courses of action and to consider all environmental factors which may affect the success of the plan. Displaying these assumptions during plan execution helps all commanders evaluate the continued viability of the plan. As long as the plan assumptions hold, the plan is likely to be viable; if one or more assumptions does not hold, then the commanders should consider either modifying the current plan or invoking an alternative.

The assumptions section contains two types of assumptions: assumptions about possible Enemy Courses of Action and assumptions about the Environment.

2.4.1. Enemy Course of Action (ECA) Assumptions

Possible enemy courses of action are the actions that the commander believes the enemy could take against friendly forces. Possible enemy courses of action are listed along the left side of the chart. Those courses of actions assumed by the plan represented by the chart are shaded. Those courses of action which are assumed will not occur are left unshaded. Figure 2-2 lists all enemy courses of action considered by Seminar #7 during planning. These included, for example, an attack on Task Force 70.5 by surface or air forces, by submarines, or by mines. The plan depicted by the chart assumes that two of these, the attacks by surface ships or by mines, will not occur while two others, the attacks

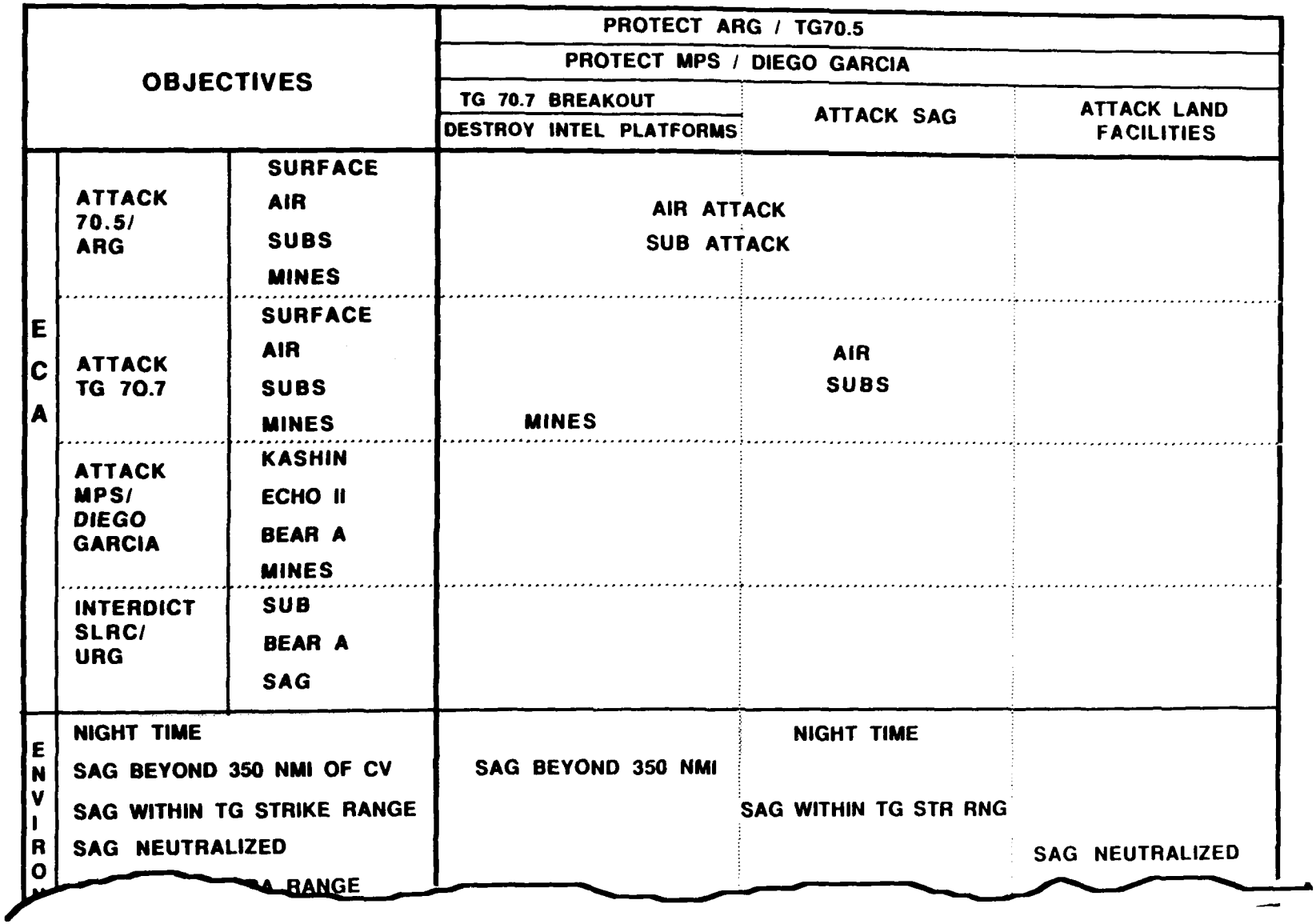


Figure 2-2. Depiction of Objectives and Assumption sections of the plan representation chart.

by air and submarine, may. Presumably, evidence of a surface attack would prompt the commander to consider switching from the depicted plan to another which assumed the possibility of a surface attack.

Often a plan assumes that enemy courses of action can occur only during some of the mission phases. These phases are indicated by the shaded areas on the right part of the chart. For example, Figure 2-2 indicates that the plan assumes that air and submarine attacks may occur during the "TG 70.7 breakout" and "attack SAG" phases of the operation, but will not occur during the final "attack land facilities" phase.

During the plan execution intelligence information would be evaluated to determine the validity of each assumption. For example, an enemy attack by submarine would be assumed to be possible only if a submarine were in a position to attack. This would be so only if the water in areas of possible attack are deep enough to conceal a submarine and permit it to attack and if a submarine would have had sufficient time to move from its previously reported position into this area.

2.4.2. Environmental Assumptions

Environmental assumptions are those aspects of weather, time, distances, geography, and topography able to impact the planned tasks. For example, "Surface Action Group (SAG) remains within striking distance" is an environmental assumption of the plan depicted in Figure 2-2 because enemy forces must remain within range of strike aircraft for the mission objective "Attack Surface Action Group (SAG)" to be accomplished. Only assumptions that might possibly not hold are listed. This one is listed because the enemy force could move beyond range of TG 70.5 strike aircraft, making the planned strike impossible. Like the assumptions about possible enemy courses of action, shading indicates the operational phases during which various environmental conditions are assumed to hold.

Sometimes a commander will prepare several alternative plans, with each one assuming that some particular set of conditions will occur and that others will not occur. For example a commander might plan one set of actions if weather prohibits flight operations from an aircraft carrier and another set of actions if flight operations can be conducted. The chart for each of these alternative plans would have an environmental assumption about the weather: one would be, "weather suitable for flight operations;" the other would be, "weather prohibits flight operations."

The outcome of tasks in earlier phases of the plan may be environmental assumptions of later phases. For example, the "attack land facilities" phase of the plan pictured by Figure 2-2 assumes that the enemy Surface Action Group (SAG) has been neutralized. These assumptions indicate how the outcome of earlier phases of the plan affects the execution of later tasks.

2.5. Directive Section

The directive section of the chart specifies the tasks and actions to be performed in order to achieve the mission objectives. This information is placed below the assumptions section, and occupies the lowest portion of the plan representation chart. The directive section was not included in Figure 2-2, but is shown partially in Figure 2-3.

The label section on the left of the chart lists organizational elements responsible for the different tasks, and notes the general purposes of these tasks. The organizational elements listed in figure 2-3 include the P-3 at Diego Garcia, the Amphibious Readiness Group (ARG), Task Group 70.5 including the aircraft carrier (CV), the oiler Leftwich, B-52 bombers, the strike force on the carrier, and aircraft with sensors for threat detection, identification, and localization. The missions of these units are listed at the left of the organizational elements. For example, the P-3 at Diego Garcia are tasked to destroy intelligence platforms. The sensors, B-52, and CV strike force have two missions: to strike the Kiev Surface Action Group and to strike hostile land facilities.

The right portion of the chart portrays the time sequence of tasks and actions to be performed by these organizational elements. Each task or action is represented by a separate block on the chart . Blocks are arranged on the chart in the sequence that the tasks or actions are to be performed, and are associated with the appropriate operational phase. For example, during the phase of the operation "destroy intelligence platforms" the P-3 at Diego Garcia will launch at 0800, will first attack the intelligence gathering ship (AGI), and will then attack the Kashin. During the phase "attack Surface Action Group" these P-3 will patrol against hostile submarines and surface ships.

Time increases from left to right on the chart, so that actions placed toward the right are expected to occur after those placed at the left. There is no explicit set time scale for the chart, and an inch on the chart may represent different time intervals at different points at the chart. Therefore, the precise starting time for a task cannot be inferred from the position of the task on the chart. Furthermore, since all blocks are approximately the same size, the duration of a task is not reflected by the length of the block representing the task.

The chart represents time in this non-literal way in order to accommodate the temporal uncertainties inherent to plans. A plan cannot specify the exact start times and durations of all tasks because some of these times cannot be predicted accurately when the plan is developed. It is not possible, for instance, to predict when hostile forces will choose to attack or when these forces will be detected.

The alternative to this non-literal time representation would be to depict a "most likely" plan execution sequence on a chart with a literal time scale. In this depiction, each task block would be positioned at its most likely start time, and the length of a task block would be proportional to the expected duration of the task. This alternative was not selected because it could suggest incorrectly that the plan requires that all events have the particular start times and durations shown, and that the plan is not working if tasks take longer or start later than expected. In general, plans are flexible enough to accommodate

OBJECTIVES			PROTECT ARG / TG70.5			
			PROTECT MPS / DIEGO GARCIA			
			TG 70.7 BREAKOUT DESTROY INTEL PLATFORMS			ATTACK SAG
ECA	ATTACK 70.5 / ARG ATTACK TG 70.7 ATTACK MPS / DIEGO GARCIA INTERDICT SLRC / URG		AIR, SUBS AIR, SUBS, AND MINES			AIR, SUBS AIR, SUBS
	ENVIRONMENT ASSUMPTIONS		SAG BEYOND 350 NMI			NIGHT TIME SAG WITHIN TG STR RNG
DIRECTIVE	DESTROY INTEL PLTS	DGAR P3 (2)	LAUNCH 150800	ATTACK AGI	ATTACK KASHIN	ASW/ ASUW PTRL/ ATTK
	PROTECT ARG	ARG		UNDERWAY 151200		
	TG 70.7 BREAKOUT	TG 70.7			EXIT HORMUZ	
	PROTECT MPS	MPS				DEPART DGAR 151800
		LEFTWICH	DETACH 150800	TRANSIT TO MPS MODLOC		
	STRIKE KIEV SAG AND THE LAND FACILITIES	SENSORS	LAUNCH 150800	LOCATE KIEV SAG	TRACK KIEV SAG	
		B-52				LAUNCH (2) H-3 151800
		CV STRIKE FORCE				LAUNCH H - 1.5 151930

Figure 2-3. Partial representation of a plan for the early phases of the mission, with emphasis on the Directive section.

some variability, and will remain viable when some actions are delayed or take longer than usual.

Since the non-literal depiction of time did not confuse the students at the Naval War College, it seems satisfactory for the hard copy charts used in this research. When the charts can be computer generated and automatically updated, then it may be possible to represent time more literally.

Even though time is not represented literally in the layout of the chart, absolute and relative event start times and event durations are noted on the chart whenever possible. Absolute time of execution of a task or duration of a task is written in a block whenever it is specified in the Commander's Estimate or OPORDER or can be inferred from these documents. The P-3 launch time, for example, will occur at 0800.

A relative start time for a task is noted on the chart when its absolute time cannot be known in advance, but its time relative to other events can be. For example, the launch time for a strike against the Surface Action Group (SAG) cannot be specified because the strike cannot be launched until the SAG is located, and this time is not known. The plan may specify, however, that the strike will begin at particular time relative to other events. Figure 2-3. indicates the the B-52 will take off at "H - 3", 3 hours before the SAG is to be attacked.

Locating the SAG is an example of a "trigger" event. These are events whose occurrence, at whatever time, causes initiation of other actions. Once a trigger event occurs, the absolute times of all tasks related to it can be estimated, and annotated on this display. On hard copy displays, such as the kind used in this research, these times are written on the chart. On computer generated displays, the triggered event can be moved on the floating time line to place it in its proper sequence with other tasks. Other tasks whose occurrence have a temporal relationship with "attack enemy Battle Group" are also adjusted on the "floating" time line to place them in their proper sequence.

The information in the "directive" section may be different for different levels of command and for different commanders at the same level. The Task Group Commander's chart contains a summary of tasks sufficient for him to track progression and viability of the overall plan. The chart for each Warfare Commanders may show more detail in the part of the plan that that commander is responsible for, while retaining a summary description of the tasks of other Warfare Commanders. This description of other Commanders' tasks reminds each Commander of the overall plan, and may help him anticipate the intentions of the other Warfare Commanders.

Like the other sections of the plan representation chart, this section is intended to support both planning and plan execution. During planning, this section can provide a visual continuity to the plan. It may give planners insight into the plan's suitability, feasibility, and acceptability by indicating conflicts between organizational units, by making apparent inadequate time intervals between tasks, and by showing inconsistencies between planned events and underlying assumptions.

The chart is intended to support plan execution by supporting supervision, plan modification, and coordination among Warfare Commanders. It can support plan supervision, the determination of whether the plan still enables mission objectives to be met, by depicting the planned tasks, task schedule, task assumptions, and mission objectives. It supports plan modification in the same ways that it supported planning. It supports coordination by showing each Warfare Commander the tasks assigned to all Commanders, helping a decision maker identify those revisions that are least disruptive to the current organization and current intentions of the different Warfare Commanders.

3. THEORETICAL AND DOCTRINAL FOUNDATION OF PLAN REPRESENTATION CHART

3.1. Introduction

The chart described in the previous section was motivated by a concept of distributed decision making, by a psychology theory of situation assessment and individual "recognition-based" decision making, and by Navy doctrine.

Each of these factors is important to the design of the plan representation chart. The concept of distributed decision making motivated the choice of a plan representation chart for supporting coordination among the Battle Group decision makers. The psychology theory guided the selection of chart content and format. It suggested information presentations organized to support cognitive processes used in decision making. Doctrine guided the chart content by specifying factors important to Navy planning and plan supervision. This section reviews each of these three factors and relates them to the plan representation chart.

3.2. Distributed decision making

Distributed decision making is a special type of team decision making. In distributed decision making all members of the team are guided by a common plan which specifies actions to be taken in different types of situations. When making a decision, each decision maker, guided by the plan, individually selects actions which further group goals. Decision makers may choose to consult with others before making a decision, but are not required to do so. Team members may be spatially separated and linked only by uncertain communications. Furthermore, they may have different responsibilities, different areas of expertise, and access to different information.

Distributed decision making differs from group consensus decision making. In consensus decision making the group as a whole reaches a single agreed upon decision. In distributed decision making, there are many individual decisions, each made to support an overall goal. The group "decision" is the aggregate of these many individual decisions.

In the Navy Battle Group, the Officer in Tactical Command, the Anti-Surface, Anti-Air, and Anti-Subsurface Warfare Commanders form a distributed decision making team. These individual decision makers are guided by a plan which is summarized in an operations order. Each decision maker is expected to follow the plan, but is also expected to exercise initiative to take advantage of unforeseen opportunities and minimize unforeseen risks. When making a decision, each warfare commander is expected to evaluate its impact on the overall mission objectives, taking into account its impact both on his assigned tasks as well as on the tasks assigned to others.

In an effective distributed decision making team, decisions made by each team member support each other to further overall team objectives. In an ineffective team, decision makers may take actions which may fail to support others on the team, and which may, in fact, undermine other team members.

Many factors may promote effective distributed decision making. Factors important in our concept of distributed decision making are a common understanding of the plan, a shared situation interpretation, an ability for each decision maker to accurately assess the impact of his actions on other decision makers, and an ability for each to anticipate what others may do.

The plan representation chart is intended to support distributed decision making by reenforcing a common understanding of the plan, by fostering a more uniform situation interpretation, and by summarizing the interacting roles of all decision makers.

3.3. Cognitive basis for plan representation chart

Since the effectiveness of the distributed decision making team depends on the quality of the decisions made by the individual team members, information presentations able to improve the quality of decisions made by each team member should improve team effectiveness. The plan representation chart is intended to improve these decisions.

The organization and content of the plan representation chart was guided by a cognitive model of situation assessment and individual decision making. This model suggests principles for displaying information in a way that parallels a user's internal model of the information and that supports its use in decision making. Displaying information in this way may offer many advantages. As stated in the report Impact and Potential of Decision Research on Decision Aiding:

> "Displays which represent information in accordance with a user's own internal model should be more readily utilized, should be understood more quickly and accurately, and should provide a more effective context for eliciting on-the-spot user knowledge" (Cohen, 1987).

The principles which guided the plan representation chart were derived from a model of recognition-based decision making and problem solving. This model defines an internal representation of knowledge and associated information processing used by experienced decision makers. The model presented here reflects ERA research funded under the Distributed Tactical Decision Making program (Noble and Truelove, 1985; Noble, Boehm-Davis, and Grosz, 1986; Noble, Boehm-Davis, and Grosz, 1987), field observations of experienced military decision makers (Klein, Calderwood, and Clinton-Cirocco, 1986), research in expert problem solving (Chi, 1981), and research in classification and situation evaluation (Hintzman, 1986; Whittlesea, 1987; Kahneman and Miller, 1986).

3.3.1. Recognition-based decision making and problem solving

The model of recognition-based decision making was selected to guide the plan representation chart because this model may be especially relevant to military decision making (Klein, 1986) and expert problem solving (Chi, 1981).

In recognition-based decision making a decision maker recognizes that a new problem can be solved with methods used in similar previously experienced problems. To

use this method, the decision maker must recognize that the current situation resembles previously experienced situations in ways that preserve the applicability of the previously taken solution method. He must also be able to modify appropriately the components of the previous solution method when the new situation is not exactly the same as any previously experienced ones.

Recognition-based decision making differs from the classical rational outcome calculation model of decision making. That model assumes that people make decisions by generating a set of alternatives, evaluating an outcome associated with each of these alternatives, associating a utility or desirability score with each outcome, and selecting the alternative with the highest utility. In contrast to the recognition-based model, the classical model does not suggest how the alternatives are identified.

Recognition-based and outcome calculation decision making are not mutually exclusive. People probably use both strategies to make decisions. For some problems people may tend to use processes described by the rational outcome calculation model. For other problems, the recognition-based decision making model may be more accurate. For still others, the decision process may be a hybrid of the two methods. The two models complement each other, and when applied to problems for which they are suited are both potentially useful guides in decision aid design.

Decision aids based on the rational outcome calculation model of decision making emphasize different processes from those which assume recognition-based decision making. Aids which assume the former model usually emphasize outcome calculation. They include models that help the decision maker evaluate the consequences of alternative options. In contrast, a decision aid intended to support recognition-based decision making would emphasize aspects of the situation which influence the applicability of different standard alternatives.

Techniques for supporting recognition-based decision making derive from models of situation assessment. These models describe the underlying memory organization and associated information processing that enable people to recognize the current applicability of previous actions. Section 3.3.4 summarizes the model that guided the design of the plan representation chart. The following example is presented to help explain that model.

3.3.2. Example of expert problem solving

Expert problem solving, like recognition-based decision making, appears to depend on situation recognition. Its key component seems to be associating a type of problem with a promising solution approach. Because expert problem solving and recognition-based decision making may be so similar, they may share many cognitive processes and be understood in terms of similar models.

The following example, which describes the cognitive processes used by experts solving physics problems in mechanics, is presented to clarify processes used in recognition-based decision making. The data described here were collected by Michelene Chi (1981). The model of memory organization, however, is based on our own research

and the classification model of Hintzman (1986). Although this example is about physics, we assume that the process illustrated also applies to military problems.

The problem to be solved is:

> "A block of mass M is dropped from a height X onto a spring of force constant K. Neglecting friction, what is the maximum distance that the spring may be compressed?"

The goal of solving the mechanics problem evokes a list of basic different "standard" ways that such problems can be solved. This list is short and contains only general methods known to the problem solver. Among the methods mentioned by experts were solution by conservation of energy, by center of mass, by Newton's laws F = ma, and by conservation of momentum.

The key to solving this problem is to recognize which of the standard solution methods will work for here. This recognition is a form of situation assessment, where the "situation" is the problem statement and the "assessment" is the identification of the solution method.

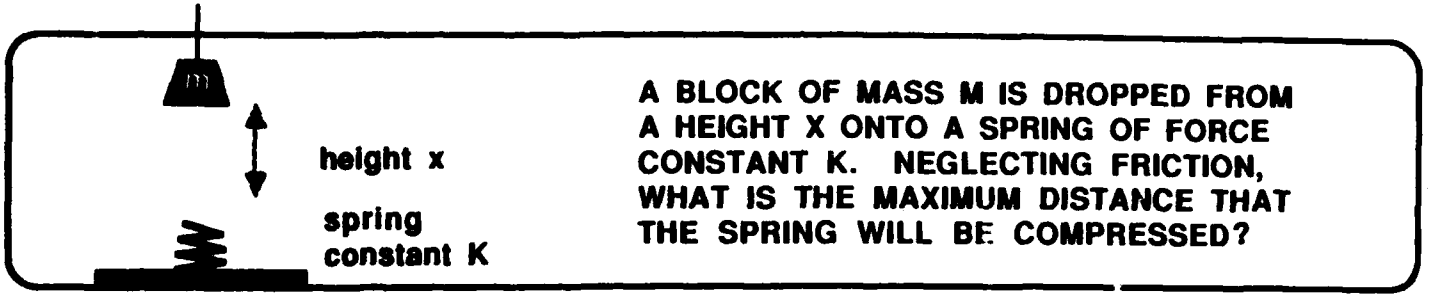
According to the theory, the experienced problem solver recognizes the solution method likely to work for a new problem by comparing the new problem with previously solved problems. Each of these previously solved problems is encoded in memory as a processed feature list (Figure 3-1). Items on this list include the problem objective, the successful problem solution method, and physical and functional problem features relevant to that method. Physical features are objects and relationships between objects. For the physics problem these include the mass to be dropped, the spring, and the lack of friction. Functional features are abstract properties of the problem which enabled the solution method to succeed. Experts mentioned such functional features as "before and after situations", "well defined final conditions" and "no friction" as properties characteristic of problems able to be solved using conservation of energy.

The general problem solution method may have several different components. For mechanics problems solved by conservation of energy, these components include finding the "before" energy, finding the "after" energy, equating these two energies, and solving the resultant equation. These components can be associated with different functional features of problems able to be solved with that solution method. In this example the functional feature "well defined final condition" is associated with the solution step of finding the "after" energy.

Determining that a particular new problem can be solved by a particular solution method is accomplished by comparing the properties of new and previously experienced problems and by testing the applicability of the general solution method.

When two problems share similar objectives, physical properties, or functional properties then they may also share similar solution methods. Problems share physical properties when they contain similar objects related in similar ways. They share functional

A PREVIOUSLY SOLVED PROBLEM



IS ORGANIZED IN MEMORY AS A PROCESSED FEATURE LIST

LITERAL	PROBLEM OBJECTIVE	PHYSICAL FEATURES	FUNCTIONAL FEATURES	SOLUTION METHOD
				CONSERVATION OF ENERGY
PROBLEM STATEMENT "A block of mass m is dropped from ...."	SOLVE MASS-SPRING PROBLEM	A MASS TO BE DROPPED A SPRING NO FRICTION	BEFORE AND AFTER SITUATIONS WELL DEFINED FINAL CONDITIONS NO FRICTION	FIND "BEFORE" ENERGY FIND "AFTER" ENERGY SET THEM EQUAL

Figure 3-1. Representation of a solved physics problem in an expert's memory. This figure illustrates how the example in the text would be represented after it is solved. Problem statement and data on functional features were reported in Chi, Feltovich, and Glaser (1981).

properties when the physical objects perform the same functions. Evaluating functional features of problems able to be solved by conservation of energy requires determining that the problem has well defined before and after energies and that no energy be dissipated as friction. In this example the problem statement explicitly mentions the lack of friction, the compression of the spring is a well defined final condition, and the initial position of the mass is the "before" situation in a "before and after situation".

Once a promising general solution method for the new problem is identified, the method must be tested to ensure that it will actually work for the new problem. Checking that the solution method will work requires that concrete expressions be found for the before and after energies. In this problem the initial and final energies are mgX and $5ky^2$, where "X" is the height of the mass and "y" is the maximum spring compression. Note that finding these concrete expressions has also proved that the new problem has some of the functional features associated with problems able to be solved by conservation of energy methods.

3.3.3. Model of underlying cognitive processes

The following cognitive model describes the internal representation of knowledge and associated information processing that support recognition-based decision making and problem solving. There are five main aspects to this model:

1. Knowledge is represented internally in terms of specific concrete examples.

2. Each example is expressed as a processed feature list. Each of these features may be represented at several different levels of abstraction. The feature may be a "literal" representation, like a photograph. It may be an abstracted physical feature, like the number of surface ships in a hostile surface action group. Or, it may be a functional characteristic, like "ability to shoot missiles". Each of these features may be represented by its own "embedded" feature list which describes the characteristics of the feature in more detail.

3. When the examples are previously encountered problems, then the feature list may include solution methods and the objectives of these solutions. Like other features, these may be represented at multiple levels of abstraction and may be described in more detail by an "embedded" feature list. These embedded detail features may be components of the solution method. Such components may be associated with particular problem features.

4. A new example retrieves old examples by feature matching. Retrieval depends on the similarity between the features of the new example and those of the old ones. Old examples that have several features in common with the new example are more likely to be retrieved than those with fewer features in common.

5. Recognition-based problem solving methods include the following, possibly subconscious, information processing steps:

a) The goals and physical features of a new problem retrieve previously experienced problems with similar goals and features.

b) A complete processed feature list is retrieved with each problem. This list includes physical features, functional features, and solution methods.

c) Some of the physical features of these retrieved problems may not match the corresponding physical features of the new problem. In that case, general world knowledge is used to determine whether these features match at a functional level of abstraction.

d) When a match between a new problem and old problems is sufficiently high, then the solution method used in the old problem is tentatively adapted. Each component of this method is tested to determine if it is compatible with all relevant functional features of the new problem. These tests may use general world knowledge.

3.3.4. Reflection of cognitive processes in plan representation chart

Figure 3-2 shows the connection between the plan representation chart format and content and the theory of memory organization for expert problem solving. Features of the chart motivated by the theory of memory organization include:

1. Each separate plan option is represented by its own plan chart. If a plan specifies different actions to be taken under different conditions, these different actions are shown on separate charts rather than as branches on a single chart. This aspect of the chart reflects the theory assertion that previously solved problems are represented in memory.with separate memory traces.

2. Mission objectives are depicted on the chart. In the theory of expert problem solving objectives key possible solution methods.

3. The chart contains assumptions necessary for the plan to work. These assumptions are the conditions under which this plan is to be executed. Plan assumptions correspond to problem functional features necessary for the problem to be solvable using a general solution method.

4. The chart shows the sequences of actions needed to solve a problem. These actions correspond to the components of the general solution method.

5. Component actions are associated with plan assumptions. In the theory of memory organization, problem functional features are often related to components of the problem solution.

These features reflect the cognitive model when applied to plan representation When applied to other problems, the same cognitive model may suggest other ways to organize information "in accordance with a user's own internal model." In the future, a more general set of guidelines of information presentation principles may evolve. These

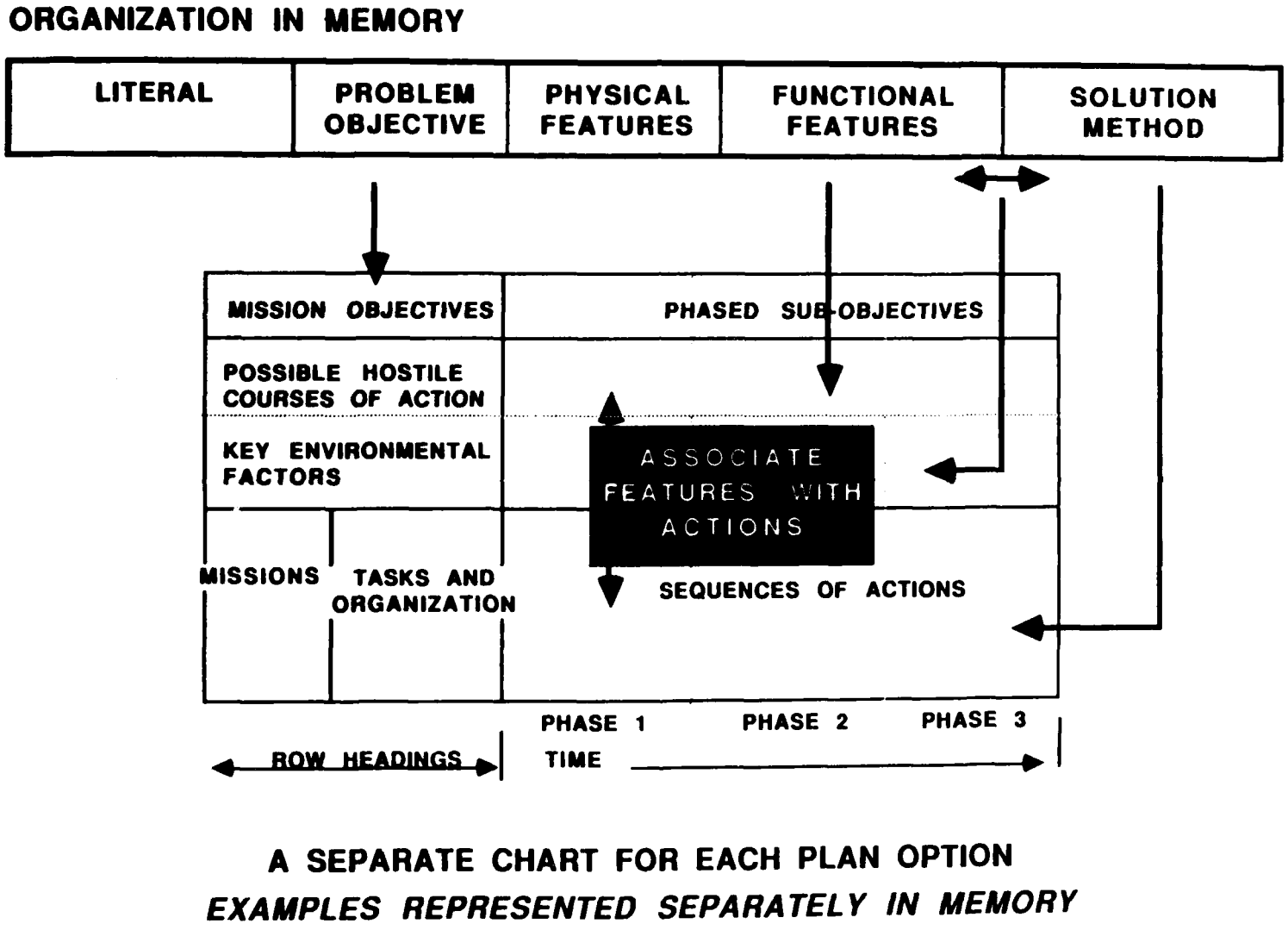


Figure 3-2. Relationship between the theory of memory organization and the plan representation chart.

principles would suggest the content and format of charts intended to support different judgments and decisions. Principles of information presentation in charts able to support recognition-based decision making might include:

1. Represent each way to solve a problem with a separate chart.

2. Index the chart by problem goals, and show these goals prominently on the chart.

3. Show functional problem features that should be present for this problem solution method to work.

4. Depict the steps required by the general solution method and associate these steps with related functional situation features.

The first principle reflects the hypothesis that memory is organized around specific examples. The second reflects the assumption that task goals evoke examples which represent basic different ways to attain these objectives. The third principle reflects the role of functional features in determining the applicability of a solution method. The last principle reflects the association of particular functional features with particular components of the solution.

Information presented according to these guidelines may be "in accordance with the user's internal model," and consequently may have the advantages presumed to arise from such presentation. For example, they should be "understood more quickly and accurately," and should "provide a more effective context for eliciting on the spot user knowledge." The observations at the Naval War College, described in Section 5, suggest that the plan representation charts have these desired properties.

3.4. Doctrinal basis for plan representation chart

Navy doctrine dictates general procedures for military activities. The two doctrinal issues most critical to this work are the Composite Warfare Commander doctrine for organization of the Battle Group, and the doctrine for developing and supervising war plans.

3.4.1. Composite Warfare Commander (CWC) doctrine

The CWC doctrine defines the distributed decision making organization of the Navy Battle Group. According to this doctrine, there is one overall commander, three warfare area commanders, and several asset coordinators.

The overall commander is the Officer in Tactical Command (OTC). He is responsible for directing the Battle Group Operations. Reporting to the OTC are three Warfare Area Commanders, the Anti-Surface Unit Warfare Commander (ASUWC), the Anti-Air Warfare Commander (AAWC), and coordinators for Electronic Warfare (EWC), Submarines, and Lamps helicopters. Each of these commanders is assigned assets needed to perform his mission. Conflicts for assets are resolved by the OTC.

The CWC organization normally practices centralized planning and decentralized execution. During the planning process the OTC, his staff, and the Warfare Area Commanders work together to develop a single plan. During execution, the Warfare Commanders usually disperse to different ships in the Battle Group, where each commander initiates actions according to the plan. Warfare commanders are expected to exercise initiative to take advantage of anticipated opportunities or manage unforeseen risks. Each Warfare Commander, therefore, may often develop options not explicitly stated in the plan. The OTC usually directs by exception. He reviews options proposed by other commanders, and may modify or forbid them.

3.4.2. Planning

The objectives, assumptions, and directive sections of the plan representation chart reflect Navy planning and plan supervision doctrine. Planning and plan supervision doctrine is described in Navy War Plan (NWP) 11. The following very brief review of Navy doctrine mentions those aspects that are most directly reflected by the plan representation chart.

Planning contains three general phases: commander's estimate of the situation, development of the plan, and preparation of the directive. In the first phase the commander, with the support of his staff, decides on a general course of action to achieve his mission objectives. In the second phase he organizes his forces for implementing the decided course of action and assigns tasks to the organizational elements. In the third phase, he prepares a directive which details specific tasking to his forces.

Figure 3-3, taken from NWP-11, outlines the steps in the commander's estimate of the situation. Higher authority tasks the commander to attain specified objectives, and provides the resources for this mission. The commander begins by reviewing these objectives. After this review, he identifies considerations affecting the possible courses of action, including environmental factors such as weather and geography, as well as comparative positions and strengths of own and enemy forces. He then reviews intelligence evaluations summarizing the different basic types of operations the hostile forces are capable of conducting, and identifies different enemy courses of action (ECA's) to be considered in subsequent planning steps. He also identifies own courses of action potentially able to achieve mission objectives. In formulating his decision, the commander attempts to synthesize a single course of action which will enable him to accomplish his mission for as many future conditions as possible. In doing so, the commander will attempt to manage the uncertainty associated with the possible enemy courses of action. He may do so with actions that close off a possible enemy course of action, such as mining a harbor, and he may allocate forces which enable him to withhold final commitment until the course of action chosen by the enemy becomes clear. Actions contingent on enemy actions or environmental conditions constitute different contingency plans.

In the second phase of planning, the commander develops his plan. He breaks the course of action for each contingency plan into discrete tasks and assigns these tasks and resources to organizational units. This results in a sequenced list of actions to be taken by

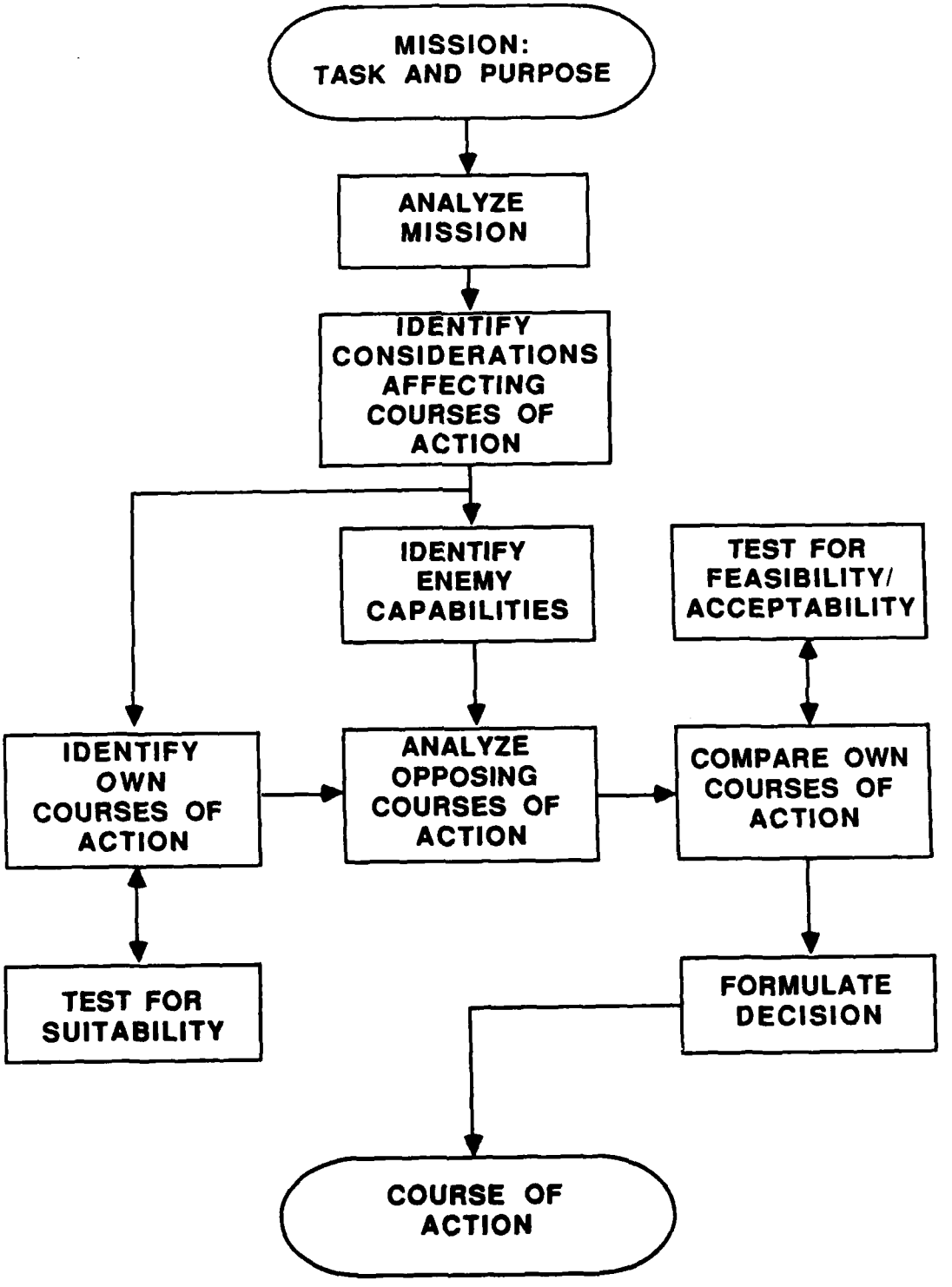


Figure 3-3. Process for Commander's Estimate of the Situation, as prescribed by NWP-11.

each organizational element, given an assumed enemy course of action and assumed environmental conditions. The plan may also specify rules for coordinating these actions.

The final phase of planning is preparation of the directive. In this phase the commander describes the mission objectives, tasks, and organizations in a plan directive.

3.4.3. Plan Supervision

In plan supervision, the commander evaluates the progress of the plan, decides whether plan changes are needed. If they are, then he revises the plan. Figure 3-4, which is adapted from NWP-11, summarizes plan supervision.

When evaluating plan progress, the commander judges whether the plan will still enable mission objectives to be met. He may judge that the plan will not work if critical plan assumptions are not true or if earlier planned actions were not successful. Therefore, plan supervision entails comparing current conditions with plan assumptions, comparing the progress of planned tasks with the schedule specified by the plan, and comparing objectives likely to be achievable under current conditions with the objectives of the plan.

If the plan will not enable the mission to be accomplished, the commander must judge whether the chosen course of action can be made to work with minor revisions, or whether a new concept for attaining mission objectives is required. If possible, developing a new course of action should be avoided, for major plan changes risk significant misunderstandings about the new planned actions. Changes that entail relatively minor changes to tasking and resource allocation are preferred.

3.4.4. Reflection of doctrine in plan representation chart

The objectives, assumptions, and directive sections of the plan representation chart reflect information required by Navy planning and plan supervision doctrine.

The chart contains information required by the Commander's Estimate (Figure 3-5) Objectives are reviewed in the "mission analysis" step of the Commander's estimate, environmental assumptions are listed in the "considerations affecting courses of action" step, and possible hostile courses of action be specified during "identification of hostile capabilities".

The directive part of the chart depicts key elements required in the Directive document. It specifies the organization of the Battle Group for carrying out the mission, the tasks to be performed by each organizational element, and the timing of these tasks

This same information is important in plan supervision. In reviewing progress of the plan and need for plan changes, the Commander considers objectives, assumptions, and tasking. Objectives are the criteria for mission success. A plan no longer able to meet these objectives requires modification. Assumptions are the premises of the plan. If anticipated assumptions do not hold, then the continued viability of the plan should be reviewed. The directive specifies tasking. If this tasking can no longer be carried out, then the plan may need modification.

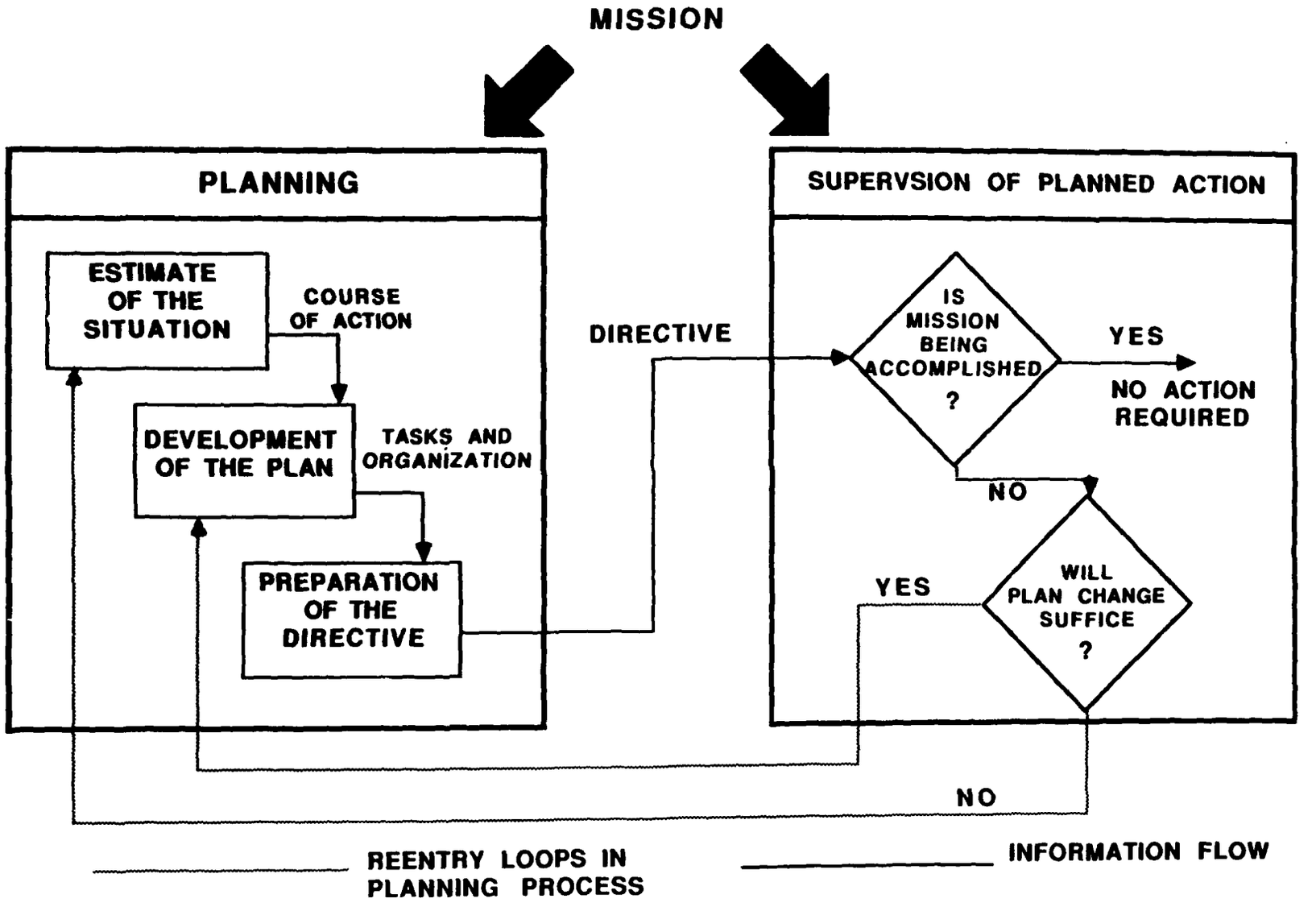


Figure 3-4. Navy doctrine for planning and plan supervision, as prescribed by NWP-11.

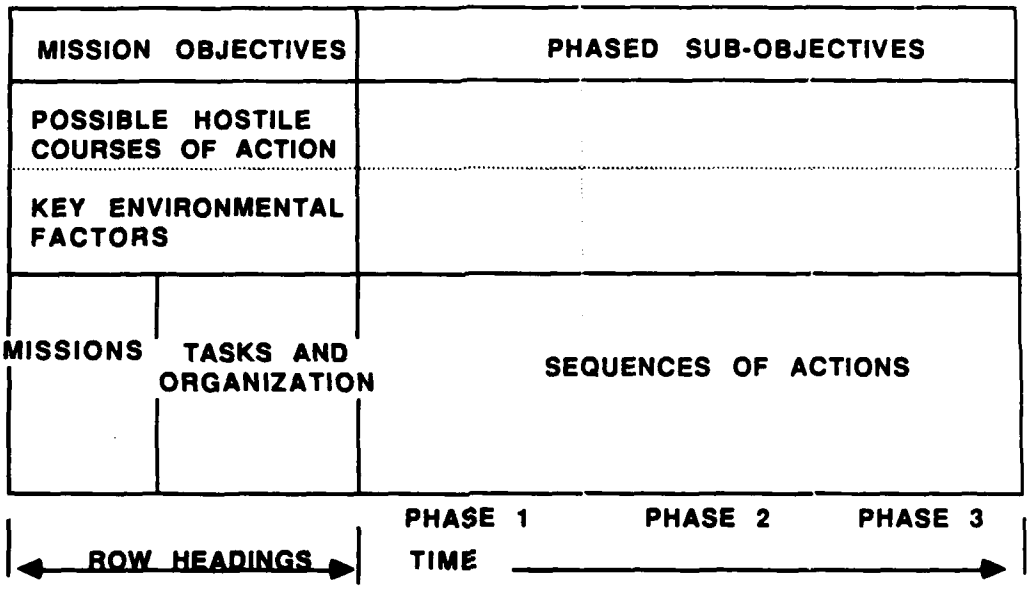
war coll 3-4

FROM COMMANDER'S ESTIMATE

OBJECTIVES

POSSIBLE HOSTILE COURSES OF ACTION

ENVIRONMENTAL FACTORS



FROM DIRECTIVE

MISSIONS

FORCE ORGANIZATION

TASKS

Figure 3-5. Navy planning doctrine in the plan representation chart.

4. DATA COLLECTION ENVIRONMENT

4.1. Introduction

The Naval War College provided an opportunity for evaluating the proposed information presentations in a realistic war game environment. Our research required this type of realistic environment because we wished to determine how well the information presentation principles discussed in the previous section could be applied to displays useful in operational Navy command and control situations.

Research conducted in a war game environment has both advantages and disadvantages compared to research in controlled laboratory settings. The latter environment permits careful control of key experimental variables and allows the replications necessary to attain statistically significant results. These types of experiments, however, may be highly artificial, bringing into question the relevance of the research results to human behavior in realistic settings. In contrast research in field settings are usually more easily related to actual human behavior, but are much less able to produce unambiguous easily interpreted data.

These evaluations of the information presentations in a Naval war game were subject to the advantages and disadvantages of field research. This section describes this environment, discussing both the research opportunities as well as the constraints imposed by the War College setting. It also briefly reviews the war game facility and procedures. In addition, as an aid to understanding the plan representation charts shown in section 5, it summarizes the war game scenario.

4.2. Command and control student war game

4.2.1. Class organization

The research setting was the student Battle Group war game. This war game is an important part of command and control instruction. It provides an opportunity for students to practice planning procedures taught in the classroom and to exercise their plans in a realistic war game.

Students playing the war game represent all four services, but are mostly Naval Officers with a rank of Lt. Commander. Class size is 150 students, who are divided into ten sections of about fifteen students each. Each of these sections is led during the planning phase by a moderator who is a member of the Planning and Decision Making instructional staff. During the game,the performance of the seminar as it executes its plan is monitored by a member of the "Warfare" faculty.

For the war game, each of these sections is organized to represent a Navy Battle Group. Since the Battle Group organization is decided by the students selected to play the senior roles, each section is organized somewhat differently. All sections are organized, however, within the guidelines established by the Composite Warfare Commander (CWC) doctrine . The Battle Group is lead by an Officer in Tactical Command with a war game rank of Rear Admiral. He is assisted by a chief of staff. Other students are assigned

important roles as the warfare area commanders for anti-surface, anti-submarine, and anti-air activities. War College gaming staff assume roles for umpires and for intelligence officers. A member of the Strategy and Operations faculty plays "higher authority". Their responses to requests for guidance and information are influenced by the instructional purposes of the war game.

In the Battle Group game, the sections play against War College staff rather than against each other. The staff, which has available ground truth information, selects actions which are consistent with hostile military doctrine, which further hostile objectives, and which advance the curriculum educational objectives. Because of this emphasis on instruction, there is a weak relationship between the quality of student decisions and the outcome of the game. The instructors controlling the hostile forces may take actions against better teams which offset their superior decisions.

Each section spends about two weeks in planning and playing the war game. Planning, which is allotted five hour and a half sessions, is done in a classroom. The war game play takes place in the Naval War College gaming facility. It occupies about four half days spread over a two to three day period. Because of physical limitations, all groups cannot play the game simultaneously. In the February 1988 course, two sections played first, four played the following week, and four teams played one week later.

The distributed decision making research conducted by Engineering Research Associates was designed to minimize interference with the curriculum educational objectives and distractions to the students. There were no experimental manipulations of the scenario, nor were special situations introduced during the war game for testing the effectiveness of the information presentations or for investigating coordination.

This environment did permit useful student feedback on the potential contribution of the plan representation chart to distributed decision making. Students provided formal documents describing their plans, which ERA then represented in the format of the chart, and were available to answer questions about the chart or about reasons for their decisions.

4.2.2. Facility

The war game is supported by a computer which tracks and updates the status of ships and aircraft in the game. The war game computer calculates the results of actions taken by the players and staff, computes sensor detections, calculates and displays movement of platforms, determines tactical information able to be observed by each of the different players, and displays this information on the appropriate game terminals. The computer also keeps a game history.

The war gaming spaces at the Naval War College include a large war game floor for umpires and separate player rooms. The game floor contains separate stations for each of the controllers assigned to play the roles of platform commanders subordinate to the students playing the OTC and each of the Warfare Area Commanders, and for the staff playing the hostile forces. These controllers monitor the war game activities, input into the

war game computer actions directed by the players, input hostile actions, and provide information to the players.

The players' area is divided into separate rooms for each command station. In the Battle Group student war game, the OTC and Anti-Submarine, Anti-Surface, and Anti-Air Warfare Area Commanders occupied separate command centers. Commanders were permitted to walk between rooms corresponding to command stations on the same ship. They could not walk between command stations on different ships.

4.2.3. Information and communications support

Each player room contains computer-generated information displays and communications capabilities similar to those available operationally. In addition, many players prepared and displayed their own hand-drawn charts

The two types of computer--generated information displays are an enhanced Naval Tactical Data System display and automated status boards. There were no computer-generated information displays similar to the plan representation chart evaluated in this research.

The enhanced Naval War Gaming System (ENWGS) provides locations and identification information overlaid on map outlines. The display is not "ground truth" but includes only information that would have been available from sensors. Unlike the NTDS system presently deployed operationally, this display codes displayed platforms by color and provides sensor detection and threat range circles.

The automated status boards display tables of dynamic status information on five computer monitors. The war game participants can select the type of information to be displayed. Options available include the status of friendly aircraft, hostile track data, and the Battle Group communications plan.

In addition to these information displays, other charts created by the participants could be hung on the walls or laid on a large plotting table. These are not standard, and different groups of players developed different charts. Several groups updated a large map on the plotting table. This map showed the current positions of friendly assets and and the latest reported threat locations and movements. No group developed a chart similar to the one prepared by ERA, which were taped on the wall in spaces provided for player-developed charts.

Communication between players on different platforms, higher authority, and the staff intelligence officer is conducted by voice over simulated radio and by message over Teletype. Voice communication provides much of the time critical information exchange. This information supports tactical decision making and coordination among the Battle Group components. It is not, however, automatically integrated with the computer-based displays described above. Messages communicated over Teletype document information previously transmitted over voice circuits, and convey other information that is not time sensitive.

4.2.4. War game procedures

The student Battle Group war game has two phases: planning and plan execution.

Five half days are devoted to planning. In the first three days the students develop a Commanders Estimate. This estimate reviews mission objectives, possible hostile courses of action, key environmental considerations, and the strengths and weaknesses of possible own courses of action. It also describes the selected general course of action. During the next two days the students develop the Operations Order. This document describes the Operations Plan, which specifies the Battle Group organization and the tasks and resources allocated to each organizational element. The Operations Plan is the principal guidance for the conduct of the mission.

The war game execution occurs over a two to three day period. It begins with a brief of the plan. This briefing reviews the objectives, the threat, and the major tasks assigned to each warfare area commander. A map is usually used when describing the plan.

During the war game execution, the students separate to their designated command posts. Early in the game emphasis is on collecting information about possible hostile activities, positioning available assets needed for the operation, and requesting additional assets from higher authority. Later, emphasis shifts to strikes against hostile forces and defense against attacks.

Between major phases of the game, typically before or after each day's play, the entire seminar gathers to review the war game progress. An important part of these meetings is a running Commander's Estimate. This reviews the progress of the plan, with discussion of what, if any, plan changes are needed to meet mission objectives.

4.3. Indian Ocean Scenario

The Indian Ocean Scenario used for the Command and Control student war game is challenging. It specifies several different mission objectives which cannot be met simultaneously with available resources and which may conflict with one another. For example, defending one part of of the force leaves other parts vulnerable. Its rules of engagement impose significant difficulties because some of the countries nearest the Battle Group are declared to be neutral but sometimes actively cooperate with hostile forces.

The following description briefly summarizes the Indian Ocean war game scenario. It is described in more detail in the seminar 7 Commander's Estimates and Operations Orders reproduced in Appendices A and B. This summary description should make the plan representation charts shown in section 5 easier to understand. Figure 4-1 shows the initial positions of friendly forces and the estimated positions of hostile forces.

4.3.1. Situation

The U.S. and Soviet Union are at war and the Soviet Union and Warsaw Pact have invaded Western Europe. The Soviet Union will likely try to disrupt the flow of oil from

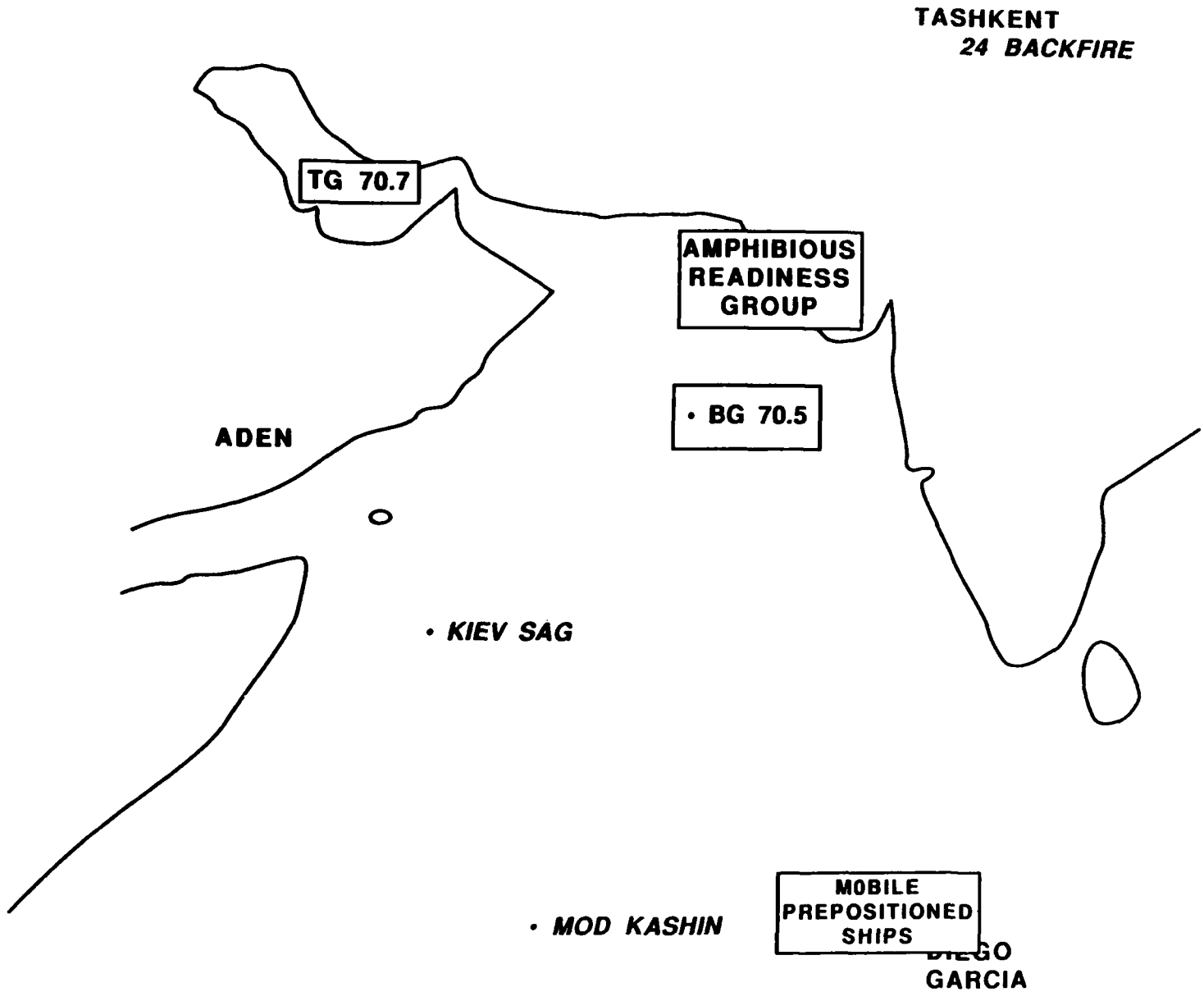


Figure 4-1. Indian Ocean Scenario for Command and Control Battle Group game.

the Persian Gulf where a display of U.S. resolve in the region is important. A U.S. Amphibious Readiness Group with 2000 civilian evacuees is to leave Karachi, Pakistan by 151200Z February 1988. U.S. Maritime Prepositioned Ships (MPS) are preparing to depart Diego Garcia.

India, Iran, Pakistan and Iraq have declared themselves to be neutral. It is expected, however, that they may cooperate with Soviet forces.

4.3.2. Threat

The principal forces threatening the Battle Group include:

1. A Soviet Surface Action Group (SAG), including a carrier, a cruiser, and four destroyers/frigates. The SAG is assembled in the Gulf of Oman. Its likely goal is disruption of oil supplies. In addition, it may attack friendly forces. There are other supporting Soviet vessels located in Dehalak and Aden.

2. Four enemy submarines, two operating in the Red Sea near Aden and two operating in the general region. These submarines have not been located since 110400Z February 88.

3. A Soviet Naval Aviation Regiment in Tashkent consisting of 44 Backfire bombers (the war game participants were told 22 until the game started), six patrol/bombers, and four reconnaissance/targeting aircraft.

4. Ships assigned to intelligence collection, including a Mod Kashin D.

4.3.3. Friendly Forces

Specific assets are described in the Seminar 7 Operations Order in Appendix B. U.S. forces allocated to the Officer in Tactical Command (OTC) included:

1. Carrier Battle Group 70.5, including the carrier Carl Vinson, 3 cruisers, and several destroyers and support vessels.

2. Persian Gulf forces, consisting of five ships.

3. Two submarines, the USS Omaha and USS San Francisco.

Other assets available to the commander included:

1. Six B-52 based at Diego Garcia.

2. Surveillance aircraft at Diego Garcia and Al Masirah.

4.3.4. Mission

The mission, as stated in the Operations Order of seminar group 7 is: "in order to neutralize the Soviet surface and subsurface capability to interdict the Indian Ocean sea lines of communications (SLOC's), TG 70.5 shall:

1. Attack/destroy Soviet surface and subsurface combatants.

2. Protect ARG A (TG 76.3) and MPS (TG 73.3) units during their transit to WestPac.

3. Attack/destroy fixed and mobile Soviet support facilities in the region."

5. RESULTS

5.1. Objectives

This research is an initial examination of the potential value of the plan representation chart to Battle Group coordination and distributed decision making. It addresses preliminary questions which must be answered prior to more extensive examinations. These questions include:

1. Is it possible to represent actual student war game plans in the format of the plan representation chart? If this format is not flexible enough to represent actual plans, then the chart cannot be used operationally.

2. Can the people who develop war game plans easily understand the chart? Can the chart format help elicit information about the plan from the planners? Can it help reveal differences in plan understanding among the planners? If the chart reflects the "internal organization of knowledge", then the first two questions should be answered affirmatively. If the chart reveals and clarifies differences in plan understanding, then it may improve coordination during the war game.

3. Is it possible to update the chart during the war game? Events rarely arise exactly as planned, and many actions actually taken are not explicitly in the plan. The chart format, to be useful for tracking the progress of the plan, must be able to accommodate these unanticipated events and actions.

4. Is the problem that the chart is intended to address, different interpretations of the situation leading to different and conflicting actions, of practical importance? If commanders rarely interpret situations differently, then they may not benefit from a chart that supports a more uniform situation interpretation.

5. Can the chart improve war game planning and plan execution? Can it help planners develop better plans and reduce coordination errors? Can it help commanders evaluate during a mission whether the plan still enables mission objectives to be met?

Each of these questions is discussed in turn in sections 5-2 to 5-6.

This research did not formally examine whether the plan representation chart leads to better decision making, better coordination, and better war game outcome. The war game environment is too unstructured to examine these issues rigorously. Control between war game groups is not possible, for every seminar develops a different plan and encounters different chance events. In addition, the connection between the quality of decisions and the success of the mission is very loose, for mission success is determined by luck and hostile actions as well as by skillful playing.

5.2. Objective 1: Representation of war game plans

5.2.1. Feasibility of representing plans

The plan representation charts were developed from two planning documents developed by the seminar: the Commander's Estimate and the Operations Orders. The Commander's Estimate includes plan assumptions and objectives. The Operations Order specifies tasks and actions to be performed by the organizational units. Chart development entailed translating the information from the narrative format of these documents to the graphics format of the plan representation chart.

ERA was able to depict the war game plan in the plan representation chart for each case attempted . ERA developed charts for the plans developed by seminars #2 and #7, and developed the objectives and assumptions portion of the chart for the plan developed by seminar #8. Two complete plan representation charts were made for Seminar #7, one for the war game Officer in Tactical Command (OTC) and another for the Anti-surface Warfare Commander (ASUWC).

Translating the information in the narrative planning documents to the plan representation chart was time consuming. It took two people working together from six to ten hours to represent the information in each set of the planning documents on a plan representation chart. The time was spent studying the plan documents, identifying key information to place on the chart, and drawing the chart. No additional planning was done during this time.

ERA had intended to develop additional charts, but did not do so because there was not enough time. Consequently, ERA did not attempt to complete the chart for Seminar #8, did not develop charts to represent additional contingencies for the Seminar #7 plan, and did not develop specialized charts for the Anti-Air Warfare Commander (ASWC) and Anti-Submarine Warfare Commander (ASWC) in Seminar #7.

The large effort required to create these charts suggests that representing plans on these charts, though theoretically possible, requires computer support to be practical. Planning software which integrates chart development into the planning process could provide these charts while decreasing total planning time.

5.2.2. Representation of Seminar #7 plan

The plan representation chart was explained in Section 2. As described there, the chart is divided vertically into three sections: an objectives section, an assumptions section, and a directive section. Important objectives to be attained sequentially define phases of the operation. These phases are represented by vertical segments of the chart. All assumptions considered important during mission planning are listed at the left of the chart. Assumptions that are premises of the plan contingency represented by a chart are shaded during the operational phases for which they pertain. The directive section specifies the time sequence of planned tasks and actions to be accomplished by each organizational element of the Battle Group.

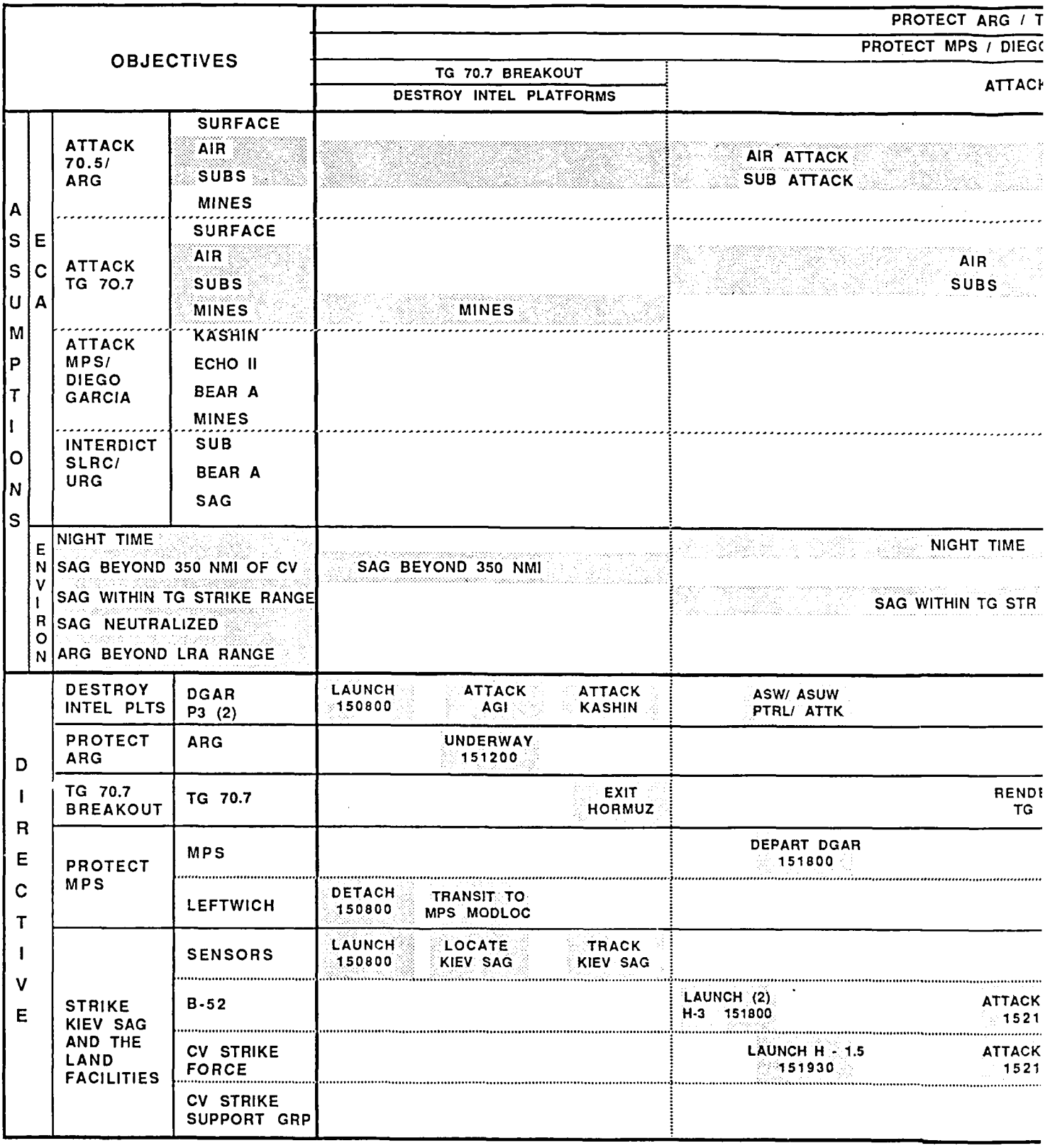


Figure 5-1. Plan representation chart prepared for Task (

CT ARG / TG70.5

MPS / DIEGO GARCIA

ATTACK SAG	ATTACK LAND FACILITIES
AIR SUBS	
IGHT TIME	
HIN TG STR RNG	
	SAG NEUTRALIZED ARG BEYOND LRA RANGE
	BEYOND LRA RANGE
RENDEVOUZ TG 70.5	
RENDEVOUZ DEPART FROM PAC	
ATTACK SAG 152100 — RECOVER/REFUEL REARM (H + 3) 160000 — LAUNCH (4) — ATTACK ADEN — RECOVER/ REFUEL/ REARM — LAUNCH (4)	
ATTACK SAG 152100 — RECOVER (H + 1.5) 152230	
LAUNCH — SUPPORT ATTACK — RECOVER/ REFUEL/ REARM — LAUNCH	

Com ed for Task Group Commander of Seminar #7.

A representation of the plan developed by the OTC of seminar #7 is shown in Figure 5-1. The chart drawn for the ASUWC differs only slightly. It includes additional detail in the strike mission of the directive.

The chart in Figure 5-1 has been redrawn for this report. The original charts prepared at the War College were drawn by hand on large sheets of drafting paper. For the plan shown in Figure 5-1 the chart measured about 4 feet by 3 feet. Objectives, assumptions, and planned tasks and actions were written on self-stick removable Post-it Note* slips and applied to chart. White and yellow Post-it slips were used for the initial plan representation. Yellow slips indicated key elements of the plan. Key elements were those assumptions, tasks and actions which, in the commander's opinion, will determine the viability of the plan. White slips are used for all other blocks on the plan.

5.2.3. Chart development procedure

The procedures used for representing the War College Seminar #7 war game plan are described below. They evolved as a result of previous attempts to represent other plans, including the sample plan in Appendix D of NWP 11, an OPORDER for a prior year's war game, and the war game plan of Seminar #2.

The chart was developed in two steps. The information in the Commander's Estimate was represented on the chart first because this document was the first one available and because it contains information needed to organize the chart. Information in the Operations Order was represented in the second step, which began as soon as the planners completed this document.

Procedure for representing information in the Commander's Estimate.

The Commander's Estimate provides the information required in the objectives and assumptions sections of the chart. The major steps in developing these chart sections are:

1. Extract objectives for each mission phase from the Commander's Estimate.

   Seminar #7's Commander's Estimate explicitly stated the main mission objectives, but did not explicitly express some of the sub-objectives. These were inferred from the discussion of the Course of Action or the Concept of Operations in the Commander's Estimate.

2. Determine major mission phases.

   These correspond to major sequentially pursued sub-objectives.

3. List Enemy Courses of Action (ECAs).

   A Commander's Estimate is required to specify possible enemy courses of action. All ECAs listed in that document are included on the plan chart. Enemy courses of action are colored yellow during the mission phases in

*Post-it Note is a registered trademark of the 3M company.

which they are expected.

4. Determine and list Environmental assumptions.

   Like ECAs, environmental assumptions are a required part of the Commander's Estimate. Some assumptions listed on the chart are stated explicitly in the Commander's Estimate, while others must be inferred. Environmental assumption blocks are colored yellow during those mission phases in which the plan assumes them to be true.

5. Elicit and incorporate comments from the planners.

   The Commander and other planners are asked individually and separately whether the chart accurately represents the objectives and assumptions of their plan.

The objectives and assumptions can be difficult to attain from the Commander's Estimate as they are not always explicitly stated. For example, the environmental assumptions discussed in the Commander's Estimate for Seminar #7 concerned the communications available to the Task Group, the type of enemy submarines in the area, and the availability of third country support bases. The Commander's Estimate did not explicitly specify critical environmental assumptions about the relative positions of opposing forces. These assumptions had to be inferred from other parts of the document.

Comments from the planners, though useful for improving the chart, were not elicited primarily for that purpose. Rather, this feedback was attained principally to determine whether the information presentation provided a useful framework for eliciting knowledge from the planners and for revealing possible differences in plan understanding among the planners. These issues are addressed in section 5.3.

Procedure for representing information in the Operations Order.

When the Operations Order became available, it was used to complete the chart. The Operations Order defines the force organization, specifies the tasks assigned to the different elements in the organization, and when possible indicates the timing of assigned tasks. This information is represented in the Directive part of the plan representation chart.

Information in the Operations Order also permits refinements to the objectives and assumptions sections of the chart. For example, the Commander's Estimate for Seminar #7 did not include assumptions about the relative positions of the Battle Group and the Soviet Surface Action Group. These assumptions were inferred from the OPORDER which specified a night strike on the Soviet Surface force, but stated that this strike was to be launched as soon as possible if Soviet CVBG approaches closer than 350 NM from CV U.S. Aircraft Carrier. This early launch would not be specified as a contingency if the plan to strike at night did not assume that the Soviet force would remain beyond 350 NM of Task Group 70.5.

The procedure for completing the chart was:

1. Develop the directive section of the chart using the force organizational elements, missions, and tasks specified by the OPORDER (Annex B).

   The names and missions of organizational elements define the rows of this portion of the chart. Tasks are placed on the time line as a sequence of events. A task is placed on the row of the organizational element responsible for performing the task, and in the column corresponding to the phase of the operation in which it is to be conducted. Explicitly mentioned times or time relationships are written on the block. These time relationships include specified task start or end times, relative start or end times, and task duration.

2. Refine environmental assumptions using information in the OPORDER.

3. Post the resultant chart for easy reference by players during the war game.

4. Ask the Commander and other planners if the chart accurately represents their plan.

5.2.4. Objective 1 summary

Operation plans were successfully represented for each case attempted. Because the content or quality of the Commander's Estimate and Operations Orders were not considered when selecting plans to represent, this success suggests that the chart can represent actual war game plans. The large effort required to produce these charts manually, however, suggests that to be practical development of such charts must be integrated into the planning process. Since the total time spent planning is far greater than the time required to create the charts, it is possible that developing these charts as part of planning may reduce total planning time.

5.3. Objective 2: Use of chart to elicit plan information

On two occasions, once after the information in the Commander's Estimate was represented and once after the chart was completed, several of the planners were asked individually if the chart represented their plan correctly. This question was asked to determine if the chart could be easily understood, if the format could facilitate eliciting plan information from planners, and if the chart could reveal possible differences in plan understanding among the decision makers.

Everyone briefed on the Plan Representation Chart easily understood the concept, format, and content of the chart. The representation of plan tasks on the floating time line required explanation, but did not confuse the war game participants. They understood the sequencing of tasks and the relationships among tasks.

The feedback attained immediately after incorporating the information from the Commander's estimate suggests that the chart may help elicit knowledge about the plan and may help reveal differences in understanding among the planners. Three of the Seminar #7 planners suggested changes to the content of the chart. The chief of staff suggested adding the objective "destroy intelligence platforms." The Anti-Surface Unit Warfare Area Commander and the Anti-Air Warfare Area Commander each added a possible enemy

course of action, the attack on the Mobile Prepositioned Ships (MPS) by the Kashin and by mining.

Because these different planners suggested different additions to the chart, this feedback suggests that they may have had somewhat different understandings of the plan objectives and assumptions. This feedback does not prove that these differences reflect genuine differences in understanding, for it is possible that all planners understood each of these issues, but did not comment on them. Each of these changes had, however, been omitted from the Commander's Estimate developed by the planners, and therefore could reflect actual differences in understanding about the plan.

5.4. Objective 3: Updating the plan representation chart

5.4.1. Feasibility of updating the plan representation chart

Events in a war game rarely occur exactly as predicted, and actions can rarely be carried out exactly as planned. Unexpected opportunities arise, and these are exploited whenever possible, often with actions not mentioned in the plan. Unexpected difficulties also arise, and these also are often addressed with actions not in the plan.

During the two war games observed, for Seminar #2 and Seminar #7, many events occurred which were not anticipated by the original plan and which were not represented on the plan representation chart at the start of the war game. In spite of this, the basic original plan remained viable through out the war game for both groups. As the game unfolded, the unanticipated events and actions were able to be incorporated in the chart. The updated chart showed the plan's progress and indicated its continued ability to support mission objectives.

Although the format of the chart itself is sufficiently flexible to accommodate the changes, the mechanics for representing the changes on the hard copy paper charts used in these experiments were awkward. It was difficult, for example, to insert new tasks in their proper sequence on the time-line. To add new tasks in sequence with tasks on every row of the chart would have required moving many of the Post-it slips that represented the planned tasks and would also have required redrawing the vertical lines delineating the plan phases. Since this was not feasible during the war game, new tasks were inserted to preserve the correct task sequence only for tasks on the affected row.

A second problem concerned coordinating the updates on the two plan representation charts prepared for the Task Group and ASUW Commanders. Coordinating these updates was sometimes difficult because these charts were maintained in separate rooms by different experimenters responding to different information. The difficulty of maintaining separate charts was one of the reasons ERA developed specialized plan charts for only two of the warfare commanders. Even had additional charts been prepared, they could not have been used during the war game. It would not have been possible for only two people to maintain and update more than two charts during war game play.

These problems were not caused by the nature of the displays themselves, but by the manual procedures required for chart updating. Both problems would be eliminated were the charts updated and displayed by computer. A computer can apply uniform standards when updating all charts, can easily redraw the chart time lines to accommodate new tasks, and can maintain separate displays which reflect only the information available to the different Warfare Area Commanders.

5.4.2. Procedure for updating the chart

The procedure outlined below describes how the chart actually used at the Naval War College was modified. Before the war game began, the plan representation chart depicted all events, assumptions, and tasks with white or yellow boxes or Post-it slips. As the war game proceeded plan progress, plan changes, and significant events were recorded by coloring these boxes and by adding other colored boxes. A uniform color code was used, with blue signifying objectives, assumptions, and tasks occurring as specified by the plan and pink signifying failed objectives, conditions different from the plan assumptions, unexpected noteworthy events, and changes to tasks. The intent of these colorings was to create an overall pattern of color that would suggest at a glance how well the original plan is working. A predominance of blue would suggest events unfolding as planned. A predominance of pink would suggest that the plan may not be working and may need to be revised.

The methods for updating the chart and the color scheme for reflecting plan progress seemed to work. The war game participants easily understood the updated chart, though they did require an explanation of the floating time line. The color code made the progress of the plan and changes to the plan readily apparent to a viewer. The war game players were able to adjust their perceptions of what was happening in the war game to what was represented on the chart even though some of the added tasks could not be positioned at exactly the right time and completely within the right row.

As the war game progressed, the plan representation charts were updated using the pink/blue color code, with blue indicating events occuring as plans and pink indicated deviations for plan expectations:

- Successfully attained objectives were marked blue; objectives not able to be attained were marked pink
- Enemy Courses of Action (ECA) and Environmental assumptions which were expected to occur were marked in blue if they did and in pink if they did not.
- Assumptions which were listed on the chart but which were not expected to occur were marked in pink when they occurred.
- Enemy Courses of Actions which occurred but were not listed on the original chart were denoted by new pink Post-it slips.

- Successfully executed plan tasks were colored blue; delayed or significantly modified tasks were colored pink. Tasks colored pink were changed to blue when successfully completed.
- Plan tasks not able to be executed were marked with an "X".
- New tasks were added on pink Post-it slips.
- Blocks representing completed tasks were annotated with actual time of occurrence.

In this color code pink represented either a change in a planned task or an unexpected noteworthy event. As described below, many of the boxes added to the chart were comments on unexpected events, and these were easily confused with changes to tasks. Denoting comments by their own color would help chart viewers distinguish between task changes and unanticipated occurrences.

5.4.3. Discussions of selected chart updates

Many noteworthy events occurred during the Seminar #7 war game . When the game was halted, the Task Group had repelled an air and submarine attack, and had lost some ships. Diego Garcia and the MPS had been attacked by BEAR A bombers, but were not significantly damaged. The airfield at Al Masirah suffered a similar attack. The ARG was underway and transiting south under protection of the Task Group. The game ended before the attack on shore support facilities could be launched.

Figure 5-2 is a representation of the updated chart for the Task Group Commander at the completion of the war game. This chart has been redrawn for black and white reproduction in this report. On this chart, objectives, assumptions and tasks with check marks occurred as planned. Objectives marked with X's were not attained. Boxes colored black with white lettering indicate either new noteworthy events or tasks that were modified. Modified tasks later carried out successfully have check marks.

The following paragraphs explain some of the plan changes that occurred. Most of these are reflected directly on the chart in Figure 5-2. Some of the changes mentioned below are not shown on this chart, but did appear on the one for the ASUWC.

Change 1: Failure of TG 70.7 to exit Straight of Hormuz.

The objective "TG 70.7 BREAKOUT" and task "EXIT HORMUZ" are marked with an "X" in Figure 5-2 because the four ships that comprised TG 70.7 were severely damaged by an air attack while in the Strait of Hormuz, and consequently were not able to complete their mission to join Task Group 70.5. Failure to attain this objective did not cause the overall plan to be abandoned, but did force Task Group 70.5 to accomplish its mission with reduced assets.

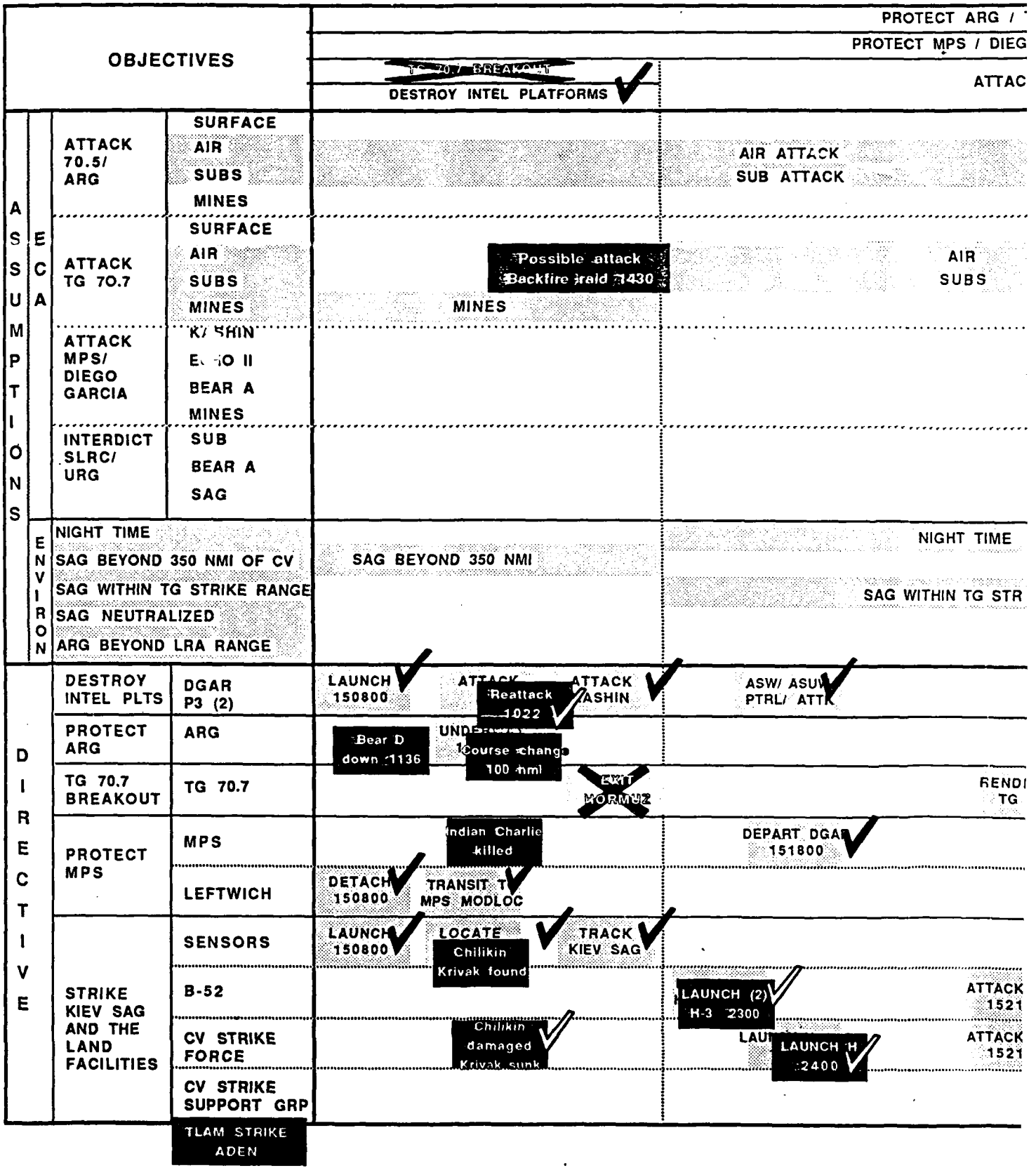


Figure 5-2 Plan representation chart prepared for Task Group C

PROTECT ARG / TG70.5 ✓		
OTECT MPS / DIEGO GARCIA ✓		
ATTACK SAG ✓		ATTACK LAND FACILITIES
AIR SUBS		
NIGHT TIME		
G WITHIN TG STR RNG		
		SAG NEUTRALIZED ARG BEYOND LRA RANGE
		BEYOND LRA RANGE
RENDEVOUZ TG 70.5		
	RENDEVOUZ DEPART FROM PAC	
ATTACK SAG 152100	RECOVER/REFUEL REARM (H + 3) 160000	LAUNCH (4)
ATTACK SAG 152100	RECOVER (H + 1.5) 152230	
		LAUNCH

ATTACK ADEN — RECOVER/ REFUEL/ REARM — LAUNCH (4)

SUPPORT ATTACK — RECOVER/ REFUEL/ REARM — LAUNCH

Detach Leftwich TD NW — Launch TL M dawn 0500 — TLAM on target

nar Task Group Commander of Seminar#7, as updated during plan execution.

Change 2: Second attack on AGI.

The objective "DESTROY INTEL SHIPS AND AIRCRAFT" is checked, indicating that it was successfully attained. However, attaining this objective required two attacks rather than the single planned attack. The first attempt to "ATTACK AGI" by P3 aircraft based at DGAR (Diego Garcia) was unsuccessful, and a new task "REATTACK AGI" was added. This new task is represented on the chart by an additional black box. The check on this box and on the objective "DESTROY INTEL SHIPS" indicates eventual success.

Change 3: New tasks "ATTACK CHILIKIN/KRIVAK"

The initial search for the Kiev located two Soviet ships that had been detached from the SAG and were proceeding on their own toward TG 70.5. Finding two detached and relatively unprotected Soviet ships had not been anticipated and no tasks for attacking these ships had been assigned. This unanticipated sighting is depicted on the chart by the note "Chilikin/ Krivak found. Taking advantage of an unexpected opportunity, the ASUW Commander tasked two A-6 aircraft already in the air to attack these ships. This attack damaged one of the ships. A follow-up attack, directed by the ASUW Commander to be launched at 1200, destroyed both Soviet ships. Figure 5-2 shows these two new tasks with a single box "Chilikin Damaged/ Krivak sunk". This box was not checked after the first attack because the Chilikin was not sunk. After the second attack destroyed this ship, the box was checked.

Change 4: Delay of strike on Soviet Surface Action Group.

The original plan in Figure 5-1 shows that B-52s were to launch at 151800, ninety minutes before the CVBG Strike Force launch at 151930. These launches were timed so that both air groups would arrive together to conduct a coordinated strike on the Kiev SAG. These launches could not to take place, however, until the Kiev had been located. Since the Kiev SAG wasn't located until 151840, the B-52 launch had to be delayed. The CV strike could have been launched on schedule, but would then have reached the Kiev before the B-52s. Therefore, the Officer in Tactical Command (OTC) and the ASUW Commander agreed to modify the plan by launching the B52s at 152300 followed by the CVBG Strike Force launch at 152400. In order for these strike aircraft to complete their mission, they needed to be refueled enroute to the Kiev SAG location and again on their return. The ASUW Commander, therefore, directed that 6 KC-135 tanker aircraft be launched from Diego Garcia in advance of strike aircraft to be in position to provide the refueling service.

Change 5: Modification of plan tasks related to objective "ATTACK LAND SUPPORT FACILITIES"

The original plan tasked four B52 to attack the land support facilities. Because higher authority diverted two of these B-52 for use in another theater, plan tasks related to objective "ATTACK LAND SUPPORT FACILITIES" had to be modified. The Commander decided to proceed with attacks on support facilities using the remaining two B52s (change not shown on chart). The B52s would be supported by the CVBG Strike Support Group as originally planned. However, the Commander estimated that destroying the land facilities with two B52s would take longer than attacking them with four, and that before all support facilities could be attacked, the remaining B52s may be withdrawn for other missions. The Commander therefore augmented the air attacks with surface-to-surface missile attacks from USS LEFTWICH. This mission for USS LEFTWICK, "TLAM (TOMAHAWK Land Attack Missile) STRIKE (on) ADEN" and associated tasks were added to the bottom of the plan representation chart.

5.4.4. Objective 3 summary

The plan representation charts for both of the monitored war games were able to updated in a way easily understood by the war game participants. The success or failure of objectives were indicated easily, as were tactical conditions different from those assumed by the plan. Although many task changes were shown, most of the new Post-Its added to the directive section were comments on tasks or observations on events related to tasks rather than new tasks themselves. Plan progress seemed to be conveyed best by adding comments to the original plan rather than by redrawing this plan to reflect how it actually was accomplished.

There were several difficulties with the updating procedure. Some of these involved difficulties with redrawing the chart or maintaining consistent information on the charts prepared for different commanders. These problems would be easily corrected were the charts maintained by a computer obtaining tactical information from Battle Group information systems. One problem not easily addressed is the lack of guidelines for deciding what changes are significant enough to note on the chart or how such changes should be summarized. Such guidelines will need to be formulated before software to update the charts can be developed.

5.5. Objective 4: Relationship between coordination and situation interpretation

This research has assumed that coordination will be impaired when different decision makers interpret the tactical situation or plan differently. The extent to which differing situation interpretations is a significant factor in poor coordination depends on how frequently situations arise which lead to such differences. If these situations arise frequently, then such differences may often cause coordination errors. If they arise infrequently, then these differences may not be a significant cause of poor coordination.

ERA tried to find examples of poor coordination resulting from differing situation interpretations in the observed war games. Although we observed several instances of poor coordination, in neither of the two war games that we monitored did we observe a problem that clearly arose primarily from differing situation interpretations . In no instance did poor coordination result from differing beliefs about hostile objectives or hostile tactics for achieving these objectives.

Two examples of poor coordination which we observed are described below. In the first of these, the problem apparently arose from differing estimates of the outcome resulting from an action. In the second the problem arose because one decision maker saw an opportunity not recognized by the other.

The first example concerned a failure of the OTC to anticipate a decision by the Anti-Air Warfare Commander (AAWC). It involved the Combat Air Patrol (CAP) response to a Backfire attack on Persian Gulf ships 70.7. The AAWC chose not to use CAP to defend these ships because the rules of engagement prohibited shooting missiles from aircraft over Iranian air space. The OTC, not anticipating the AAWC decision, did not instruct the AAWC to attack the Backfire, as he later said he should have. The OTC thought that the AAWC would order the CAP to fire their missiles at the Backfire while the CAP were over the Persian Gulf. The AAWC did not do this, however, because he believed that the CAP missile range was too short for this to work.

The second example arose because the OTC saw an opportunity overlooked by the other commanders. The plan specified a coordinated air strike against the Soviet Surface Action Group (SAG). The force in the coordinated strike included land-based B-52 and carrier launched attack and support aircraft. The Anti-Surface Warfare Commander (ASUWC) was to launch B-52 against the Soviet Surface Action Group (SAG) at 1800. When the SAG unexpectedly positioned itself against the coast of Somali, the OTC saw an opportunity to improve the carrier defense by delaying the launch by three hours. The ASUWC launched the B-52 at the originally planned time, and the OTC needed to recall them. In this example, the OTC either neglected to inform the ASUWC of the plan change, or the ASUWC, not understanding the change, did not react to it.

The OTC explained the reason for his decision. When the carrier strike force is attacking the SAG, the reduction in fighter assets would reduce the carrier's ability to defend the Battle Group against the anticipated Soviet Backfire attack. Consequently, the carrier is somewhat vulnerable during this period. Also contributing to the Battle Group vulnerability are rules of engagement which prohibit air assets from employing offensive weapons over Iranian airspace. These vulnerabilities were recognized in the original plan. One way to reduce the carrier vulnerability during the strike against the SAG would be to postpone this strike until the Battle Group could move to a location less exposed to the Backfire. The carrier becomes less vulnerable when it moves beyond 300 miles from the coast, a distance that permits the defending fighters to engage the Backfire over ocean rather than over Iran. This 300 mile distance provides a Backfire engagement zone of 100 miles between the coast and the Backfire launch range. The original plan to attack the SAG at 1800, while the carrier was still within 300 miles of the coast, was earlier than desired,

but was chosen to limit the possibility that the SAG would move out of strike range of the carrier. The movement of the SAG to Somalia eliminated this possibility over the next few hours and permitted the carrier strike to be delayed.

After the B-52 were recalled, ERA asked each of the two Warfare Area Commanders affected by the plan change why the OTC had delayed the strike. The ASUWC, who was responsible for the strike against the SAG, thought that the strike was delayed because Somalia had not yet given permission to attack the SAG near their coast. The AAWC, whose mission was the primary beneficiary of the decision, could not think of any reasons for the delay.

Figure 5-3 illustrates how the plan representation chart, had it been able to be updated in a timely manner and used to support communication among the decision makers, could have reduced the likelihood of this coordination error occurring. The highlighted boxes explain the two ways that the chart can help. First, by emphasizing the strike delay in the directive section, the chart would help the ASUWC be aware of the plan change. Second, by emphasizing the assumption "SAG within BG strike range", the chart would have helped the ASUWC understand the reason for the plan change, that an early attack is now not so important because the SAG can no longer move beyond the range of carrier strike forces.

Although the accuracy of the commanders' situation interpretations did not appear to limit the quality of decisions in this war game environment, situation interpretation might be much more important in more realistic operational conditions. This war game scenario tended to reduce the importance of situation assessment to decision making. In this scenario, the most critical hostile course of action, the attack by the Backfire based in Tashkent, was nearly certain to occur. In the games ERA observed, the hostile forces did not use much cover and deception. In addition, the sensor data and intelligence reports were reasonably good. Finally, communications among the Warfare Area Commanders was nearly unrestricted.

Though not a critical factor in this war game, the importance of situation assessment in general was suggested by questions that one of the instructors asked the students. After observing the student response to the first wave of Backfire attacking the Persian Gulf force, this instructor asked what was likely to occur next. Was this first wave likely to be the entire attack? If not, what were the subsequent waves likely to be like? How many waves would there be, what direction would they come from, and how many aircraft would each wave contain? These questions imply the importance to decision makers of knowing and taking account of hostile doctrine and tactics in military decision making.

5.6. Objective 5: Potential value of charts--feedback from war game participants

The results on plan representation and plan update suggest that the plan representation chart has the potential to support plan supervision and coordination. It is feasible to represent and update plans in this format, and plans so represented were easily understood by the war game participants. The feasibility of representing plans this way

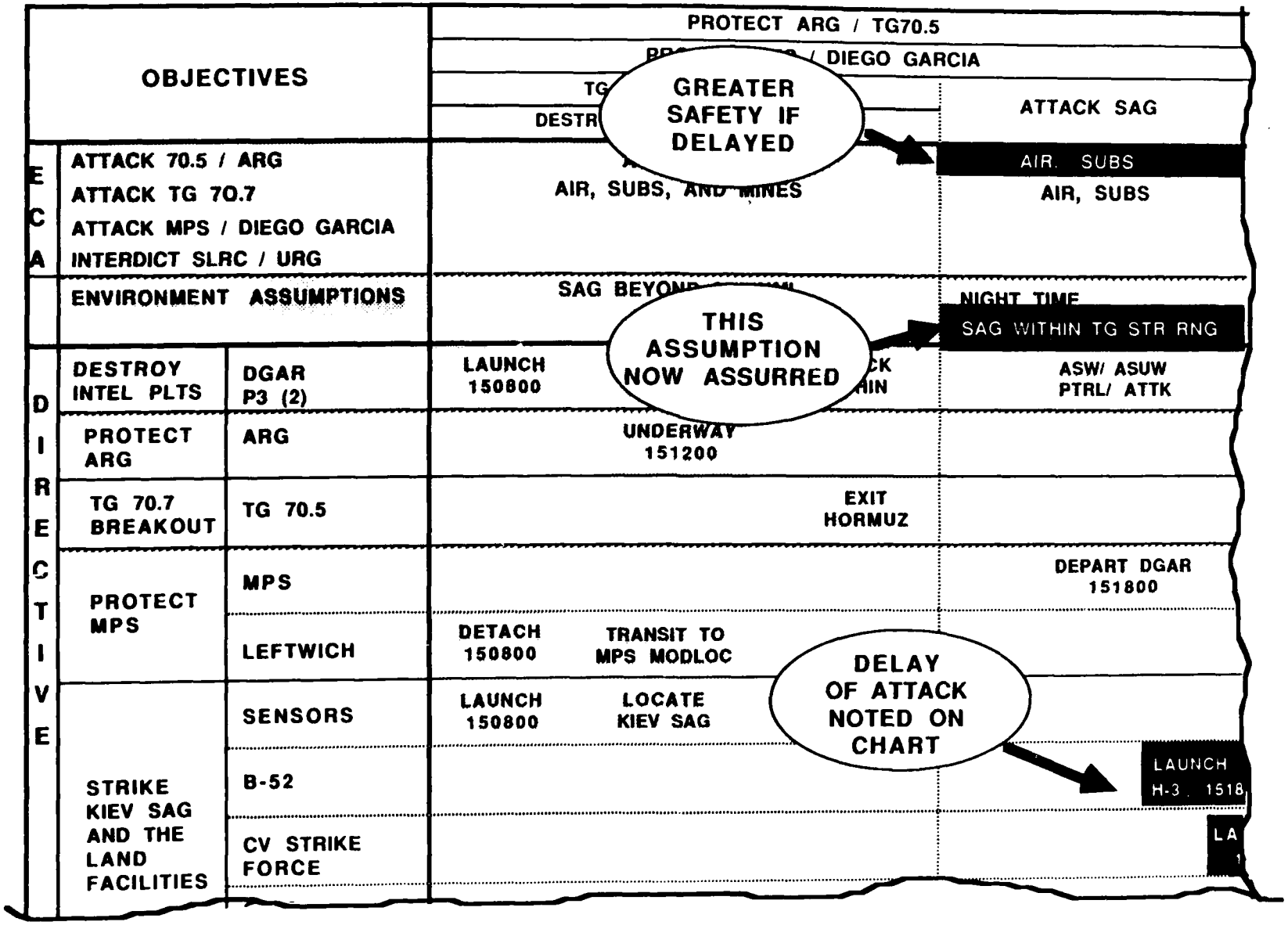


Figure 5-3. Depiction on the plan representation chart of the OTC decision to delay strike against SAG.

war coll 5 3

does not, however, prove that it is actually useful to do so. It does not prove that these charts will actually improve plan supervision, coordination, and distributed decision making.

These experiments did not attempt to measure the direct contribution of the plan representation chart to Battle Group decision making. It was judged more important to assess the feasibility of supporting distributed decision making with these charts before attempting to test their actual contribution under different warfare conditions. Nevertheless, feedback from the war game participants suggests that this type of plan representation may prove beneficial. This feedback came in three ways: spontaneous use of charts by the participants, elicited feedback, and general comments.

5.6.1. Spontaneous use of chart

Based on responses from the War College staff and Seminar war game participants, the presentation provided a necessary but missing perspective of the operations. In the two War Games monitored, at no time were participants noticed referring to the traditional narrative Commander's Estimate or the OPORDER during play. At least twice, however, the plan representation charts were referenced. One officer referenced it, he said, for seeing "the big picture." The other, when asked why he looked at it said "Just seeing where we are."

The utility of the chart was also suggested when the Task Group Commander of Seminar #8 asked for a copy of the chart before starting his war game. The requested chart was not complete; it contained only the parts developed from the Commander's Estimate, the objectives and assumptions sections. When ask why he wanted it, he said, "It will be a good reminder."

A third indicator of the chart's potential usefulness was the interest shown by a war game participant who suggested a change to the chart format. He suggested that the directive section specify the mission of each Task Force organizational entity. This suggestion was implemented, and even commented on by a student from a later seminar as a good feature of the presentation format.

5.6.2. Prompted use of charts

As lulls in action occurred, the Task Group Commander, the ASUW Commander and their staffs were asked two questions: "what are the possible enemy courses of action at this point?" and "would their original plan still meet their mission objectives?" In several cases the war game participants members referred the plan representation chart before answering these questions.

5.6.3. General comments from Seminar students and instructors

Several war game players and three Seminar moderators were asked if they thought the chart had any real utility to war game play or Navy operations. These war game participants generally felt that the chart contained the essential elements that a commander

would need to track a plan. They thought that the chart included sufficient reminders and "check points" for evaluating the viability of a plan. Some of the specific responses were:

> "It provides the 'big picture' that isn't available elsewhere."
>
> "(Plan tasks section) displays what an operations officer carries in his pocket on a scrap of paper."
>
> "The information is good, but the chart is too big for easy reading."
>
> "It would be more helpful if it were on a computer."
>
> "(Plan tasks section) and objectives would be nice to have at remote terminal."
>
> "It would be helpful to be able to develop our plan this way if it were on a computer."

In sum, many students and some War College staff members commented that the concept was a good one and offered encouragement to continue development. They felt, however, that the plan development and plan updating processes should be computer-based. It was suggested that had it been possible to build the representation while developing the plan, it would have helped with organization, resource assignments and sequencing actions. Further, one staff member suggested that the concept be expanded to permit plan development using a computerized version and having the OPORDER automatically generated from it.

Should such work be undertaken, methods for capturing the planning processes with a software tool that generates the plan representation chart would need to be identified. In encouraging this work, two senior staff members of the War College offered continued consultation to further develop the concept.

6. RESEARCH ISSUES

6.1. Introduction

This report has described an initial effort to apply a psychology theory to information presentations able to support distributed decision making in the Naval Battle Group. The psychology theory describes how information used by experienced decision makers is encoded in memory and used for situation interpretation, decision making, and problem solving. The information presentations represent plans. They are intended to support distributed decision making by helping all decision makers have a better and more uniform understanding of the plan, by helping them be alert to critical tactical conditions that bear on the continued viability of the plan, and by reminding them of the different responsibilities and tasks of all Battle Group decision makers.

There were several noteworthy accomplishments of this effort. It was possible to apply information presentation principles developed from the psychology theory to charts representing war games plans at the Naval War College. As would be expected from a chart organized to be in accordance with the "internal representation of information in memory," these charts proved easy to understand and useful for eliciting plan information. In addition, the charts were sufficiently flexible to be updated as the plan was executed, and consequently could be used to represent the progress of the plan in meeting mission objectives. Finally, the war game participants generally commented favorably on the chart, suggesting that such presentations, if integrated into the Battle Group tactical information system, might contribute to military effectiveness.

As suggested by this short review, this work has two different and complementary focuses. One focus is on fundamental theoretical issues of distributed decision making. This research examined psychological theories of cognitive processes and applied these theories to distributed decision making. The second focus is on practical aids that support command and control operational requirements. This research defined information presentations for new operational aids able to support planning and plan supervision.

Work in neither area is complete. This section discusses very briefly some of the key unresolved theoretical issues, and describes principal features of possible new operational aids.

6.2. Unresolved theoretical issues

6.2.1. Models of decision making and problem solving

The cognitive processes used for decision making and problem solving are not yet understood and are the subject of considerable current research (Neisser, 1987). During the past few years there has been considerable progress in this research, resulting in new theories of memory organization, situation interpretation, decision making, and problem solving.

The models used in this work reflect these new theories. The model of memory organization emphasizes the importance of specific exemplars rather than summary

descriptions of concepts. These exemplar models propose that in situation interpretation the characteristics of features in a new example are calculated from the characteristics of analogous features in similar old examples. Unlike some older theories, these newer theories do not assume that these characteristics are inferred from an abstract descriptive model nor do they propose a central role for knowledge encoded as if-then statements. Finally, the model of decision making used here emphasizes the importance of situation recognition which enables previously experienced solution methods to be applied to new problems. This decision making model deemphasises the importance in decision making of explicitly computing the consequences of alternative courses of action.

All of these models are still being developed, and will likely evolve considerably in the future. As the understanding of these processes improves, their potential for aiding distributed decision making should increase.

6.2.2. Information presentation principles

The plan representation chart supports judgments and decisions that depend on evaluating the continued viability of a plan during warfare. This chart was guided by a model of memory organization for expert decision making. Its content and organization reflected the content and organization of memory.

The model of memory organization can likely guide the design of other charts that support different judgments and decision tasks, but may do so in ways different from those used for the plan recognition chart. It may be possible to formalize these different ways with a set of general information presentation principles. Section 3 suggested four such principles for charts which support problem solving. These were to represent each general solution method on its own chart, to make explicit the objectives of the solution method, to show the functional features of a problem indicative of the general solution method, and to associate each of these functional features with components of the solution method.

These principles are general and abstract. It should be possible to identify more powerful information presentation principles than these, even given our limited current understanding of the underlying psychological processes. As our understanding increases, we should be able to identify new, improved information presentation principles which are less general than the four mentioned above. These principles should provide more definite guidance on the format and content of information presentations intended to support judgment and decision making. They should indicate the types of presentations best suited to supporting different types of decisions and different styles of decision making.

6.2.3. Causes of poor coordination

A premise of this research was that effective distributed decision making depends on a common understanding of the plan and a shared situation assessment among decision makers. Neither of the two cases of poor coordination documented in this report were caused by differences in plan understanding or situation interpretation. One occurred because two decision makers did not agree on the outcome likely to result from a proposed

action. The other occurred because one decision maker identified a course of action overlooked by the others.

These observations may reflect the special conditions of the observed war games rather than conditions generally characteristic of warfare. It is possible that coordination difficulties may occur more frequently and for different kinds of reasons in other environments where the potential actions of the hostile forces are less restricted, where available tactical information is less complete, and where communications are more restricted.

6.2.4. Effectiveness Assessment

This research did not try to measure the actual contribution of the chart to better decision making, improved coordination, or better mission outcome. Data measuring this contribution, though very desirable, would be difficult to attain. Measures of effectiveness for decision quality and coordination are elusive, the connection between decision quality and outcome quality is highly variable, and the war game environment complicates control of experimental variables.

Decision quality has been difficult to measure, particularly when the decisions are not repeated, because bad decisions are sometimes followed by good outcomes and good decisions sometimes lead to bad outcomes. This problem was particularly true in the war games observed at the Naval War College, because the instructors sometimes manipulated the war game outcomes for instructional purposes.

Since outcome is not always a good measure of effectiveness for decision making, other measures based on intervening variables have been proposed. These have included the number of alternatives generated, the number of factors considered in projecting these alternatives, and the accuracy of estimated outcomes. These particular measures may not be valid, however, for research has shown that experienced decision makers make better decisions than less experienced ones, but may consider fewer alternatives and concentrate less on estimating outcomes (Chase and Simon, 1973). Possibly measures based on other intervening variables may work better. Identifying and validating these measures may require better models of expert decision making than exist today.

6.3. Operational aids

The plan representation charts discussed in this report provide the foundation for new types of operational aids for mission planning and for plan supervision.

As used in this research, with manual construction and hard copy format, these charts could not easily support operational requirements. In this research, each plan representation chart was developed from the Commander's Estimate and the Operations Order prepared by the students. The charts were drawn by hand on large pieces of poster paper, a process that took several hours. During the plan execution, the charts were updated by hand. Because the charts were on hard copy, they were awkward to revise. In

addition, because the charts were not integrated with other tactical information systems, they were hard to update accurately and quickly.

To become practical to use operationally the preparation and presentation of these charts require computer support. Two aids based on the plan representation charts are described below. One of these aids planning. The other aids plan supervision.

6.3.1. Planning aid

The planning aid provides software for developing plans and preparing the plan representation chart. Like project planning software, this software helps the planner relate the different elements of the plan to one another, helps him test the feasibility of the plan, and provides specially formatted plan representation charts which helps him communicate the plan to others.

The software for aiding development of military plans would support the operational planning steps prescribed in NWP-11 and would format and print the plan representation chart. Prior to using this aid the commander would have completed the Commander's Estimate phase of planning, and would have selected a general course of action. During the phase of planning supported by the aid, the Commander will "translate the selected course of action into tasks that need to be carried out" and will "establish an organizational structure for doing so" (NWP-11).

The aid architecture is motivated by the theory of expert problem solving. This theory proposes that experts organize previously solved problems into categories based on general solution method, and that associated with these categories are functional properties of problems able to be solved by that general method (Chi, Feltovich, and Glaser, 1981).

In addition, the aid takes advantage of the fact that some tasks occur in many different types of plans and are carried out in a similar manner in different contexts. The aid data base stores key characteristics of these tasks. These characteristics include resources normally required, temporal constraints imposed by geography and duty cycle times, and implied supporting tasks. The aid presents these tasks so that their characteristics may be easily inspected and modified as needed for operations being planned.

Principal planning steps with the aid could be:

1. The planners review the chosen course of action and mission objectives. They identify tasks needed to perform the mission. Tasks in the aid data base may be retrieved and reviewed. Tasks in the operation being planned that are not in the data base are added to it. This information enables the aid in later steps to evaluate plan feasibility.

2. The planners identify necessary assumptions. The planner associates each assumption with the mission tasks whose success is affected by that assumption.

3. The planners establish relationships between tasks. Tasks may be related because they must be coordinated in time, must have particular geographic relationships, must occur in sequence, or require similar resources.

4. Planners establish rough deadlines for tasks.

5. The aid displays the selected tasks on a rough time line, and shows the relationships between different tasks and between tasks and assumptions.

6. The planners group tasks which could be accomplished by the same organization. The aid lists the resources required to perform each group of tasks. The planner determines an organization consistent with the resource requirements, with temporal and spatial constraints among tasks, and with required task support functions.

7. The aid draws the directive and assumptions portions of the plan representation chart. It depicts force organization, tasks assigned to each organizational element, rough timing of tasks, and assumptions associated with each task.

8. The planners refine the preliminary plan depicted on the aid display. The planners assign resources to the organizational elements, and when necessary specify places or times for accomplishment of the tasks. The aid software helps with these specifications by computing windows that depict feasible task times. These windows will reflect time, space, and duty cycle considerations.

9. The planners may consider several alternative plans. The software will test the feasibility of candidate plans, ensuring that adequate resources are available and that event timing does not violate time, space, and duty cycle constraints.

10. The planners select the preferred alternative.

11. The aid prints the plan representation chart.

The product of this planning process is a hard copy chart printed by the aid and a representation of the plan in the aid data base.

Because the plan representation chart contains and displays key elements of a plan--its objectives, critical plan assumptions including possible hostile courses of action, force organization, and tasks--the hard copy output of the chart can help all planners review the plan for possible needed changes, and can help the planners write the narrative Operations Order. The internal computer representation of the plan is the foundation of the plan supervision aid.

6.3.1. Plan supervision aid

The plan supervision aid presents information useful for evaluating the progress of the plan and provides software that aids replanning.

In the plan supervision aid, a computer displays and updates the plan representation chart, performing many of the functions done manually in this research. In particular, the aid:

1. Displays the status of mission objectives, showing objectives which were successfully accomplished, objectives that were unable to be accomplished, and objectives that are being addressed by ongoing tasks.

2. Displays completed tasks, tasks in progress, and future tasks on a time line. Because the computer can easily redraw tasks to accommodate time changes, the computer generated chart can represent the actual times that events begin and end.

3. Color codes completed tasks to indicate extent of task success. Color coding may require input by the operator.

4. Displays the impact of completed tasks on future tasks. The aid alerts the operator if delays in completing current tasks affect the planned timing of future tasks, if destroyed or damaged resources affect the feasibility of future tasks, or if task outcome affects tactical conditions needed by future tasks.

5. Highlights in the assumptions section the enemy courses of action indicated by current intelligence estimates. The intensity of the highlighting could reflect the strength of the evidence in support of the possible hostile course of action.

6. Adjusts the horizontal position of the assumptions bars to reflect the earliest and most likely times that anticipated hostile threats may develop or that critical environmental conditions may change.

7. Indicates when an assumption of the plan may be violated, thereby alerting the operator to the possible requirement to change the plan.

The plan supervision aid could include the software used to support the original development of the plan. This software would help with replanning.

This plan supervision aid, if made available to the warfare commanders, would help each individual commander evaluate the progress of his tasks in the context of the total mission objectives, the tactical environment, and the tasks of the other warfare area commanders. By displaying this information, the aid would help coordinate the actions taken by each commander. With this information each warfare commander can better consider the impact of possible plan changes on other warfare area commanders, and the OTC can better understand the implications of suggested changes on overall mission objectives.

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APPENDIX A

Commander's Estimate prepared by Seminar #7

G-352-88
11/10/88

(UNCLASSIFIED)

ZZ 150900Z FEB 88

FROM: CTG 70.5

TO: CTF 70

INFO: CTG 70.7
CTG 72.8
CTG 73.2
CTG 73.3
CTG 73.5
CTG 74.5
CTG 76.3
CTU 72.5.8

SUBJ: COMMANDER'S ESTIMATE FOR CTG 70.5

A. CIOTF OPORDER COMSEVENTHFLT No. 7-88 150800z FEB 88

B. NWP-11E

1. ICW REF A, the following is submitted in REF B format.

COMMANDER'S ESTIMATE OF THE SITUATION

References: NWC 4038

Step 1. MISSION ANALYSIS

1. Source of the Mission. CTG 70.5's task is taken from paragraph 3 of CIOTF OPORDER COMSEVENTHFLT No. 7-88:

"(a) Locate, attack and neutralize Soviet combatants and support vessels in the region. First priority is surface combatant forces.

(b) Protect ARG Alpha and the MPS during their transits of the Indian Ocean.

(c) Attack and destroy Soviet support facilities at Aden, Socotra and Dehalak to prevent their use in the immediate future.

(d) Anticipate re-deployment to the Western Pacific at the completion of the above tasks."

The purpose of CTG 70.5's task is taken from the mission statement of CIOTF OPORDER COMSEVENTHFLT No. 7-88 because CTG 70.5 has the main or supported role in this operation. The purpose is:

"Neutralize Soviet surface and subsurface capability to interdict Indian Ocean SLOCS in order to assist in assuring an uninterrupted supply of oil to U.S. Allies and to demonstrate the superiority of U.S. naval forces."

2. Statement of Own Mission. The combination of the task and purpose results in the following statement of CTG 70.5's mission:

"To locate, attack and neutralize Soviet combatants and support vessels in the region while protecting ARG Alpha and the MPS during their transits of the Indian Ocean and to attack and destroy Soviet support facilities at Aden, Socotra and Dehalak to prevent their use in the immediate future in order to assist in assuring an uninterrupted supply of oil to U.S. Allies and to demonstrate the superiority of U.S. naval forces."

3. Superior's Mission. CIOTF's mission as stated in paragraph 2 of the initiating OPORDER is to "Neutralize Soviet surface and subsurface capability to interdict Indian Ocean SLOCS in order to assist in assuring an uninterrupted supply of oil to U.S. Allies and to demonstrate the superiority of U.S. naval forces." CIOTF's course of action as stated in paragraph 3 is to accomplish this by neutralizing Soviet surface and subsurface combatants in the region and attacking and destroying fixed and mobile Soviet support facilities in the region. Destruction of all Soviet vessels in the area and the Soviet support bases at Aden, Socotra and Dehalak would prevent Soviet interdiction of Persian Gulf oil supplies to allied forces and establish sea superiority for U.S. naval forces.

4. Own Mission Analysis.

(a) Objective. CTG 70.5's objective is the destruction of soviet naval forces and supply bases in the area of operations.

(b) Physical objectives.

a. Soviet SAG
b. Aden port facilities, ships, airfield and aircraft at airfield.
c. Socotra anchorage support facilities and ships.
d. Dehalak port facilities and ships.
e. Tashkent airfield and aircraft.
f. Moma AGI
g. MOD Kashin at Mauritius.
h. Kilo, Echo II, Charlie I and Foxtrot submarines.
i. Soviet and WSP merchants.

(c) Contributions to Superior's objectives.

a. Accomplishment to CTG 70.5's mission will contribute to the accomplishment of CIOTF's mission through the destruction of Soviet combatants, support vessels and support facilities will prevent their use in the immediate future in order to assist in assuring an uninterrupted supply of oil to U.S. Allies and demonstrate the superiority of U.S. naval forces.

b. Military Environment of the Operations.

(1) This operation will be conducted in an environment of open hostilities.

c. Significant Elements of the Problem.

(1) Obvious planning constraints.

- Time to accomplish mission.
- Limited forces.
- Long ALOC's and SLOC's.
- Weather.
- C3 difficulties with multiple forces.
- Defense of ARG and MPS while conducting offensive operations.
- Blue on blue and blue on white engagements.

(d) Relationship With Other Subordinate Commanders in the Operation.

a. Supporting CTG 70.5.

(1) TG 70.7 (CMEF): providing ships.

(2) CTU 72.5.8: EP-3 support.

(3) TG 72.8: P-3C support for ASUW followed by ASW support for TG's 70.5, 76.3, 73.2 and 73.5.

(4) TG 73.5: Logistics support for 70.5 and 76.3.

(5) TG 74.7 Submarine support for ASUW, attack Soviet submarines when encountered.

(6) B-52G's are requested through USINCPAC.

(7) E-3A AWACS are requested through CIOTF.

b. Supported by CTG 70.5.

(1) TG 73.2 (MPS): Escort if required.

(2) TG 76.3 (ARG ALPHA) Escort if required.

5. Key Points of Analysis.

(a) CTG 70.5's objective is the destruction of Soviet naval forces and supply bases in the area of operations.

(b) Physical objectives.

a. Soviet SAG
b. Aden port facilities, ships, airfield and aircraft at airfield.
c. Socotra anchorage support facilities and ships.
d. Dehalak port facilities and ships.
e. Tashkent airfield and aircraft.
f. Moma AGI.
g. MOD Kashin at Mauritius.
h. Kilo, Echo II, Charlie I and Foxtrot submarines.
i. Soviet and WSP merchants.

Step 2. Identify Considerations Effecting Possible Courses of Action

1. Externally imposed constraints - See COMSEVENTH Operations Order para. 3.x.(1) (d) (e) (f) (g)

(a) Assumptions

(1) Echo II submarine is a Mod E with SSN-12.

(2) SATCOM available for TF 70.5.

(3) Bases in Oman, Somalia, and Saudi Arabia are available for covert support use.

(b) Rules of Engagement

(1) Cannot fly over land except for South Yemen, Socotra, and Ethiopia.

(2) Keep Damage and destruction to private property to a minimum.

(3) CJTF permission necessary for overflight of Saudi Arabia, Somalia, and Oman.

(4) No use of nuclear, biological or chemical weapons without permission from CIOTF (CTF 70.0).

(5) Soviet/Warsaw Pact considered hostile.

2. Characteristics of the Area of Operations

(a) Hydrography: ASW operations difficult due to temperature gradient of water and biological activity. Aids to navigation are adequate.

(b) Transportation: Extended SLOC's vulnerable to interdiction by enemy ASW. Diego Garcia and the Straits of Hormuz are vulnerable to mining.

(c) Weather: Wind from the NE allows steaming away from enemy when replenishing. May create operational considerations for flight operations.

(d) Political: Pakistan and India have declared neutrality. Iran may use heightening tension to cover actions against the Iraqi's. No overt use of bases currently available to U.S. Forces.

3. Relative Combat Power (See Intelligence Update #1)

(a) Strength of Opposing Forces

(1) ASW favors U.S. Forces.

(2) AAW favors U.S. Forces provided that no further bombers are forward based.

(3) ASUW forces are balanced. However, SS-N-12 is a potent threat.

(4) Strike Warfare is balanced.

(5) Mine Warfare favors Soviets.

(6) Distribution of Soviets complicates U.S. use of concentration of force.

(b) Strength and Weakness factors

STRENGTHS

U.S	Soviets
Intelligence Systems	Land Based Spt Fac
Pilot Experience	Dispersed Assets
Weapons Technology	SS # Advantage
	Mining Capability

WEAKNESSES

Limited Assets	Spt Fac Conc Vic Red Sea
Extended SLOC's	Non-night Fighting Forgers

(c) Combat Efficiency

(1) Soviet logistics are a weak link in their naval operations. Short SLOC's, but land based support facilities.

(2) U.S. logistics. Long SLOC's, but at sea resupply is good.

(3) Soviets resupply facilities are channelized in vicinity of the Red Sea.

(d) Adequacy of Own Forces: U.S. Forces are currently assessed as adequate to perform the mission of neutralizing the Soviet SAG, attacking Soviet support facilities, and escorting the MPS and ARG provided that the tasks are conducted sequentially and not simultaneously. Major shortcomings are in defensive mine warfare or mine counter-measures.

(e) Composition of Enemy Forces

Type	Location
Soviet SAG	12N/58E vic Socotra Is
Kiev CVHG	
KARA CG	
Sovremenyy DDG	
Krivak I FFG	
Chilikin AOR	
MOD Kashin	Unk E of Madagascar at Mauritius
Soviet Resupply Grp	Dahalak Is in Red Sea
Petya FFL	
Mayak AF	
Ingul ARS	
Lama AEM	
Amur AR	
Don AS	

Soviet Resupply Grp	Aden
Yug AGOR	
Mer TUG	
Moma AGS	
4 x May (Maritime Surv)	
1 x Candid (Transport)	
SNA Regiment	Tashkent
22 x Backfires	
4 x Bear D (Recon)	
6 x Bear A (Bomber)	
Moma AGI	Diego Garcia
SS Force	
Kilo SS	Unk vic Red Sea entrance 110400z
Charlie I SSGN	Unk vic Aden 1020400z
Foxtrot SS	Unk Dehalak Is 130400z
Echo II SSGN	Unk 4N/83E 110400z

(f) Time and Distance Factors: With the Soviet strike aircraft located at Tashkent and the SAG at Socotra, the Soviets could possibly interdict the ARG before TF 70.5 is able to reach it or provide excorts and air defense protection.

(g) Reinforcements

(1) Soviets Forces: Ability to reinforce normal operations with SNA located in Tashkent.

(2) U.S. Forces: In support of CIOTF, 6 B-52s and 12 KC-135s at Diego Garcia are available for tasking by TG 70.5.

Step 3. Identify Enemy Capabilities

1. Enemy Physical Objectives

(a) MPS at Diego Garcia.

(b) Diego Garcia URG.

(c) ARG (Low estimated priority).

(d) SLOC Interdiction.

(e) Air Bases.

(f) Task Group 70.5 (Highest priority).

2. Initial Enemy Capabilities

(a) Attack the ARG, TG 70.5, and TG 70.7 combatants with air from Tashkent.

(b) Combined air and SAG attack against ARG, TG 70.5, and TG 70.7 combatants.

(c) Attack Diego Garcia with the SAG.

(d) Interdict TG Echo's SLOC's with the URG from Diego Garcia by surface, air, or subsurface.

(e) Defend Aden and Dehalak Red Sea logistics bases.

(f) Attack Diego Garcia with MOD Kashin.

(g) Conduct anti-SLOC campaign with air and subsurface assets.

(h) Mine Diego Garcia.

(i) Mine Straits of Hormuz.

3. Retained Enemy Capabilities

(a) EC #1

- - Conduct coordinated air and surface attack against TG 70.5, TG 70.7 combatants, and ARG A.

- - Provide limited defense of Red Sea supply points while conducting limited anti-SLOC operations in Red Sea.

- - Interdict in-transit URG operations by air and subsurface means.

- - Attack Diego Garcia with Kashin, Echo II, and Bear A.

- - Conduct anti-SLOC campaign in the straits of Hormuz by mining or submarines.

(b) EC #2

- - Conduct SAG operations against MPS and URG shipping vic Diego Garcia, while conducting supporting air attacks from Tashkent against TG 70.5, TG 70.7 combatants, and ARG.

- - Provide limited defense of Red SEa supply points while conducting limited anti-SLOC operations in the Red Sea.

- - Interdict in-transit URG operations by air and subsurface means.

- - Conduct anti-SLOC campaign in Straits of Hormuz by mines or submarines.

(c) EC #3

- - Split SAG, send portion to conduct coordinated air/surface attack against TG 70.5. Send remainder against Diego Garcia.

- - Interdict in-transit URG operations by air and subsurface means.

- - Conduct subsurface anti-SLOC campaign by mining the Straits of Hormuz.

(d) EC #4

- - Conduct air attack against TG 70.5, TG 70.7 combatants, and ARG.

- - SAG conducts sea control and defends in the vic of Socotra.

- - Interdict in-transit URG operations by air and subsurface means.

- - Attack Diego Garcia with Kashin, Echo II, and Bear A.

- - Conduct anti-SLOC campaign in the Straits of Hormuz by mines or submarines.

Step 4. Identify and Test OCAs

1. Tentative OCAs

(a) Provide escort for ARG Alpha and MPS.

(b) Destroy Soviet SAG by WAS strike.

(c) Destroy Soviet port facilities, ships, airfields and aircraft at Aden, Socotra and Dehalak.

(d) Destroy Moma AGI by P-3 launched harpoon.

(e) Destroy MOD Kashin by P-3 launched harpoon.

(f) Destroy Soviet submarines by coordinated ASW.

(g) Destroy Soviet and WSP MERSHIPS as feasible.

(h) Defend U.S. Forces from Soviet air attack.

(i) Destroy Soviet aircraft and airfield at Tashkent.

2. Concept of Operations for OCAs

(a) All OCAs:

a. Defense of U.S. Forces from air attack.
b. Attack Soviet/WSP MERSHIPS as targets of opportunity.
c. Destruction of Moma AGI and MOD Kashin by P-3 Harpoon.
d. Destruction of Soviet submarines when located.
e. Move F-14 and A-7 aircraft at NAS Cubi Point to NAS Diego Garcia.
f. Request SAM battery and Air Force TACAIR fighter deployment to NAS Diego Garcia.
g. Attach TG 70.7 combatants to TG 70.5
h. Detach Leftwich to MPS.
i. Request TG 72.8 continuous P-3 cover from Al Masirah for ARG ALPHA.
j. Request TG 72.8 continuous P-3 cover from Diego Garcia for MPS and 70.5.
k. Request Stinger detachments for MPS.

(b) OCA #1

a. Destroy Soviet SAG by WAS and submarine coordinated attack.

b. Request strikes at Dehalak, Socotra and Aden by B-52s.

(c) OCA #2

a. Destroy Soviet SAG by WAS and submarine coordinated attack, requesting B-52 support.
b. Subsequent land strikes at Dehalak, Socotra and Aden by CVBG air and B-52s.

(d) OCA #3

a. Request B-52 strikes on airfield and aircraft at Tashkent.
b. Destroy Soviet SAG and WAS and submarine coordinated attack, subsequent land strikes at Dehalak, Socotra and Aden by CV air and B-52s.

(e) OCA #4

a. Request B-52 WAS to destroy Soviet SAG with coordinated submarine. attack.
b. Land strikes at Dehalak, Socotra and Aden by CV air.

(f) OCA #5

a. Withdraw CVBG with ARG ALPHA and MPS.

3. Predictions, Feasibility and Suitability

(a) OCA #1: If successfully carried out would accomplish the mission, but is limited by B-52 assets-can only destroy one port at a time. Retained

(b) OCA #2: If successfully carried out would accomplish the mission, but is limited by time constraints. Retained

(c) OCA 33: If successfully carried out would accomplish mission, but would over tax CVBG assets and would result in probable loss of B-52 force. Rejected.

(d) OCA #4: If successfully carried out would accomplish mission, but would result in heavy B-52 loss and tax CVBG's ability to attack all ports. Retained.

(e) OCA #5: Does not accomplish mission. Rejected.

4. Retained OCAs

(a) OCA #1

a. Destroy Soviet SAG by WAS and Submarine coordinated attack.
b. Request strikes at Dehalak, Socotra and Aden by B-52s.

(b) OCA #2

a. Destroy Soviet SAG by WAS and submarine coordinated attack requesting B-52 support.
b. Subsequent land strikes at Dehalak, Socotra and Aden by CV air and B-52s.

(c) OCA #4:

a. Request B-52 WAS to destroy Soviet SAG with coordinated submarine attack.
b. Land strikes at Dehalak, Socotra and Aden by CV air.

Step 5. Analysis of Opposing Courses of Action

1. Analysis of OCA #1 versus EC #1

OCA #1 EC #1

CVBG WAS & SUB/B-52 Land Attack SAG Attack TG 70.5

Can protect ARG and MPS, but will require time (3 days) before escorts arrive at Diego Garcia.

Can destroy logistics bases (by Bombs/mines/Harpoon), but will require multiple strikes. Blue on White possible.

Vulnerable to Strait of Hormuz mining.

Probable outcome of this interaction is that the U.S. Forces would suffer heavy losses and probably would not accomplish their mission. Probable successful attack/neutralization of Soviet Comb/Surf Forces.

2. Analysis of OCA #1 versus EC #2

OCA #1 EC #2

CVBG WAS & SUB/B-52 Land Attack SAG Attacks Diego Garcia

Requires that the U.S. Forces detect the shift in SAG PIM.

Stern chase reduces ASUW capacity of the U.S. Forces.

B-52 and Ps must slow down the SAG.

Reduces the Soviet Air threat for the U.S. Forces.

Causes a threat to the URG.

The probable outcome of this interaction would be that the MPS might suffer heavy losses, but the ARG would be protected. The SAG would probably be neutralized and the B-52 Strikes on Soviet Bases would be successful.

3. Analysis of OCA #1 versus EC #3

OCA #1	EC #3
CVBG WAS & SUB/B-52 Land Attack	SAG SPLIT and Attacks TG 70.5 and Diego Garcia

Threat to the URG high.

SAG is easily neutralized with moderate losses, probable outcome would that MPS possibly suffers losses, but the ARG would be OK and B-52 attacks on logistics bases successful. TG 70.5 would accomplish it's mission with moderate losses.

4. Analysis of OCA #1 versus EC #4

OCA #1	EC #4
CVBG WAS & SUB/B-52 Land Attack	Air Attack TG 70.4 with SAG in Reserve

U.S. Forces must move West to attack the SAG.

Soviet AAW would be effective against the B-52 Strike.

Reduced air cover for the ARG.

The ARG and MPS can be protected by the U.S. Forces, but will require time before the escorts arrive in Diego Garcia.

U.S. Forces would control the parameters of the battle.

The probable outcome of this interaction would be that the U.S. would successfully attack and neutralize the Soviet combatant/surface Force with moderate losses to U.S. Forces. U.S. Forces can destroy the Soviet logistics bases with a potential loss to the B-52s.

5. Analysis of OCA #2 versus EC #1

OCA #2	EC #1
CVBG Air, Sub B-52 WAS; then CVBG + B-52 Land Attack	SAG Attack TG 70.5

Soviet SAG and SNA strike against TG 70.5 probably unsuccessful, but heavy U.S. losses likely. SAG will be defeated, surface threat to ARG decreased. Allows freedom of action against Dehalak, Socotra, and Aden. Assumes successful breakdown of TG 70.7 combatants and prosecution of Soviet Subs.

6. Analysis of OCA #2 and EC #2

OCA #2	EC #2
CVBG Air, Sub B-52 WAS; then CVBG + B-52 Land Attack	SAG Attacks TG 70.5

Soviet SAG probably decisively defeated because the CVBG can move South and combine with Diego Garcia's forces. Takes the CVBG out of NAS. Requires subsequent operations to hit the Soviet land bases. Some probability that Diego Garcia attacked with heavy losses if the CVBG does not move in time. Takes CVBG away from the SNA.

7. Analysis of OCA #2 versus EC #3

OCA #2	EC #3
CVBG Air, Sub B-52 WAS; then Attack CVBG + B-52 Land Attack	SAG SPLIT and Attacks TG 70.5 in and Diego Garcia

SAG can be defeated in detail. However, creates problem of split forces for U.S. Creates a surveillance problem for U.S. Forces. Part of U.S. Forces more vulnerable to SNA. U.S. probably will win, but heavier losses than with EC #2.

8. Analysis of OCA #2 versus EC #4

OCA #2	EC #4
CVBG Air, Sub B-52 WAS; then CVBG + B-52 Land Attack	Air Attack TG 70.5 with SAG in Reserve

Consolidates Soviet presence in area and provides protection to SAG. Correlation of forces will not favor Soviet Air, but some losses to U.S. Forces likely. Allows U.S. freedom of action if SNA defeated. Neutralize Soviet SAG. Creates a long run AAW problem for U.S. TG 70.5. Soviet SAG available to launch a follow on missile attack against TG 70.5.

9. Analysis of OCA #3 versus EC #1

OCA #3	EC #1
B-52 WAS + Sub Support. CVBG Air Land Attack	SAG Attacks TG 70.5

Soviet Analysis - SAG may damage portions of TG 70.5, provided TG defenses are successfully penetrated.

U.S. Analysis - SAG moderately damaged by U.S. Forces. Some U.S. Forces lost.

10. Analysis of OCA #3 versus EC #2

OCA #3	EC #2
B-52 WAS + Sub Support, CVBG Air Land Attack	SAG Attacks Diego Garcia

Soviet Analysis - Attack on Diego Garcia would be successful provided SAG is not intercepted by 70.5 or the B-52s and attacked.

U.S. Analysis - SAG moderately damaged by U.S Forces. Some U.S. Forces lost. If SAG not intercepted, Diego Garcia will be destroyed.

1. Outcome Predictions:

ECA's	SAG ATTACK TG 70.5	SAG ATTACK DIEGO GARCIA	SAG SPLIT ATTACK TG 70.5 and DGAR	AIR ATTACK TG 70.5: SAG IN RESERVE	
OCA's CVBG WAS+SUB. B-52 LAND ATTACK.	EVEN / NO	NO / YES	YES / NO	EVEN / NO	2
CVBG AIR, SUB: B-52 WAS; Then: CVBG+B-52 LAND ATTACK.	YES / NO	EVEN / NO	EVEN / EVEN	EVEN / YES	4
B-52 WAS+SUB. CVBG AIR LAND ATTACK.	EVEN / NO	EVEN / NO	EVEN / NO	NO / YES	4
	2	2/3	1	1/2	

1. Dual answer: top U.S./bottom Soviet.

2. Subjective matrix answer (EVEN/YES/NO).

11. Analysis of OCA #3 versus EC #3

OCA #3	EC #3
B-52 WAS + Sub Support, CVBG Air Land Attack	SAG SPLIT and Attacks TG 70.5 and Diego Garcia

Soviet Analysis - Damage inflicted on Diego Garcia, if not intercepted by (not legible). Other half of the SAG destroyed by the 2nd B-52 strike.

U.S. Analysis - SAG destroyed in detail. Diego Garcia damaged if 1/2 of SAG intercepted.

12. Analysis of OCA #3 versus EC #4

OCA #3	EC #4
B-52 WAS + Sub Support, CVBG Air Land Attack	Air Attack TG 70.4 with SAG in Reserve

Soviet Analysis - Inflict damage on TG 70.5. Project land targets to a (not legible) extent. SAG available for subsequent attacks.

U.S. Analysis - Damage to TG 70.5 likely to be sustained by air attack. CVBG must attack land targets prior to Soviet air attack of TG 70.5 (not legible) can still attack SAG and land targets.

Step 6. Comparison of Own Courses of Action

1. List of Advantages and Disadvantages

OCA #1	OCA #2	OCA #3
CVBG WAS+SUB B-52 LAND ATTACK	CVBG AIR, SUB B-52 WAS; then CVBG+B-52 LAND ATTACK	B-52 WAS+SUB CVBG AIR LAND ATTACK
(a) Advantages		
1. Mission accomplished in min time	1. Concentration of force	1. Increased ARG protection
2. Protection for ARG & MPS	2. Expeditious destruction of SAG	2. Simultaneous SAG + land attacks
3. Increased survivability of U.S. forces	3. Increased protection of ARG & MPS	3. Splits Soviet defenses
4. Divides Soviet defense	4. Increased survivability of U.S. forces	

(b) Disadvantages

1. Splits U.S. Forces	1. Allows concentrated Soviet defenses	1. Possible loss of B-52 forces.
2. SAG may not be immediately destroyed	2. Complex timing	2. Under use of CVBG air
3. Extensive coordination required	3. Longer time required to destroy Soviets	3. Limited SAG destruction

2. Final Test for suitability, Feasibility and Acceptability

(a) Suitability

a. All OCAs are suitable. All OCAs will accomplish CIOTF assigned missions. OCA #2 is more decisive due to concentration of force.

(b) Feasibility

a. All OCAs are feasible. OCA #1 and #3 do not ensure sufficient forces to guarantee first strike destruction of Soviet Forces.

(c) Acceptability

a. OCA #2 is more acceptable because it accomplishes the mission with minimal loss of U.S. Forces under all possible enemy OCAs.

3. Relative Merits

(a) OCA #1 accomplishes the mission in minimum time while protecting the ARG and MPS, but does not ensure destruction of the Soviet Forces in a first strike.

(b) OCA #2 concentrates U.S. Forces for expeditious destruction of the most immediate threat while minimizing own force attrition.

(c) OCA #3 provides maximum protection of the ARG while simultaneously dividing Soviet defenses, however, high attrition of U.S. Forces and limited destruction of the Soviet SAG is probable.

(d) Comparison of the OCAs indicates that OCA #2 is the preferred course of action.

Step 7. Decision

1. This force will neutralize all Soviet and Warsaw Pact Forces in the CIOTF operating area by conducting coordinated CVBG air, B-52 and SSN strikes against Soviet sea forces and land based sea support facilities, while maintaining defensive protection of ARG ALPHA, MPS, Diego Garcia, supporting elements, and organic task group assets.

APPENDIX B

Operations Order prepared by Seminar #7

Copy No. 15 of ___
Pacific Fleet Force
USS VINSON (CVN-70) Flagship
DTG: 091200G FEB 1988

OPERATION ORDER
Commander Task Group 70.5 No. 1-88

REF: A. COMSEVENTHFLT NO. 7-88
B. NWP - 7
C. NWP - 11
D. COMMANDER'S ESTIMATE CTG 70.5

Time Zone: Use time Zone GOLF for operations.

Task Organization: See Annex A.

1. SITUATION. A state of war exists between US/NATO and Soviet Union/Warsaw Pact. Enemy ships are operating in the Indian Ocean/Arabian Sea. ARG Alpha is completing noncombatant evacuation operations (NEO) of two thousand US citizens from Karachi, Pakistan. COMSEVENTHFLT has tasked Battle Group Echo to protect ARG Alpha and MPS ships presently located Diego Garcia during their transits to the Western Pacific to destroy Soviet surface/subsurface combatants in the Indian Ocean/Arabian Sea, and to attack and destroy fixed and mobile Soviet support facilities in the region.

a. Enemy Forces

(1) A Soviet surface action group (SAG) consisting of CVHG and escorts, last observed on 150400Z at 12N/58E.
(2) Four Soviet submarines, including an Echo II SSGN, are unlocated. Position data is two to four days old.
(3) Soviet FFL and six logistic support ships located inport of Dehalak.
(4) Three Soviet support ships located inport at Aden.
(5) Soviet Mod-Kashin last located 130400Z near Mauritius. Intentions unknown but may join SAG or threaten Diego Garcia.
(6) Soviet AGI last observed operating vicinity of Diego Garcia.
(7) One regiment of SNA Backfire bombers, six Bear A bombers, and six Bear D recon variants located at Tashkent airfield.
(8) Four May maritime surveillance and one Candid transport aircraft located at Aden airfield.

b. Friendly Forces

(1) TU 72.5.8, Indian Ocean Reconnaissance Unit, at Al Masirah will provide electronic recon/early warning for TG 70.5.
(2) TG 72.8, Indian Ocean Air Patrol and Reconnaissance Group, at Diego Garcia/Al Masirah will be conducting long range air recon operations against enemy surface combatants and regional ASW ops.
(3) TG 73.3, Maritime Preposition Squadron, at Diego Garcia will transit to Guam via Ombai Strait.
(4) TG 73.5, Mobile Logistics Support Group Charlie, operates between CVBG area of operations, Diego Garcia and Subic to provide logistics support for BG Echo and ARG.
(5) TG 74.7, Submarine Attack Group Bravo, conducts ASW/ASUW operations in support of CTG 70.5.
(6) TG 76.3, Amphibious Ready Group Alpha, conducts NEO in Karachi and will transit to Jakarta to off-load civilians.

c. Attachments and Detachments

(1) A detachment of six B-52s with 12 KC-135 tankers supporting are positioned at Diego Garcia for tasking, as required, in support of TG 70.5.
(2) Combatants from TG 70.7 except the USS LASALLE (AGF-3) will detach from CTG 70.7 and chop to CTG 70.5 NLT 151300Z Feb 1988.
(3) TG 70.5 aircraft based at NAS Cubi Point are directed to forward deploy to Diego Garcia NLT 150800Z Feb 1988.

2. MISSION.

To locate, attack and neutralize Soviet combatants and support vessels in the region while protecting ARG Alpha (TG 76.3) and the MPS (TG 73.3) during their transits of the Indian Ocean and to attack and destroy Soviet support facilities at Aden, Socotra and Dehalak to prevent their use in the immediate future in order to assist in assuring an uninterrupted supply of oil to the U.S. Allies and to demonstrate the superiority of U.S. Naval Forces.

3. EXECUTION.

a. Concept of Operation: See ANNEX B Concept of Operations.

b. Subunit Tasks:

(1) TU 70.5.1 Anti-Air Warfare
  (a) Provide air defense for all TG 70.5, TG 76.3,and TG 73.5 units.
  (b) TG 70.5 aircraft deployed to Diego Garcia from NAS Cubi Point provide air defense for TG 73.3, TG 73.5 and Diego Garcia.
  (c) Request deployment of I-Hawk battery to Diego Garcia.
(2) TU 70.5.2 Anti-Surface Warfare
  (a) Coordinate B-52 and CVBG air assets for combined strike on Soviet SAG.
  (b) Coordinate B-52 and CVBG air assets for combined attack on Soviet support facilities.
  (c) Attack as targets of opportunity all Soviet and Warsaw Pact merchants and naval auxiliaries excluding medical craft of all types.
  (d) Coordinate landbased P-3C aircraft in support of TG 70.5.
(3) TU 70.5.3 Anti-Submarine Warfare
  (a) Conduct barrier ASW operations to eliminate the submarine threat to all U.S. forces.
  (b) Coordinate landbased P-3C aircraft in support of TG 70.5.
  (c) Conduct aggressive search to locate, target and destroy all Soviet submarines in the operations area.
  (d) Coordinate ASW operations with TG 74.7.
(4) TE 70.5.0.1 Electronic Warfare
  (a) Coordinate all operational deception for the task group.
  (b) Coordinate landbased EP-3 aircraft in support of TG 70.5
  (c) Develop and enforce all EMCON plans for TG 70.5
(5) TE 70.5.0.2 Air Resources Coordinator.
  (a) Provide air assets to TG 70.5 warfare Commanders in support of their missions.
(6) TE 70.5.0.3 Battle Force Logistics Coordinator
  (a) Develop force logistics plan.
  (b) Coordinate logistic support with TG 73.5.

c. Coordinating Instructions:

(1) This order is effective upon receipt.
(2) Timing of operations will be in accordance with the instructions contained in ANNEX B.

4. ADMINISTRATION AND LOGISTICS:

a. Submit reports IAW NWP 7.
b. UNREP will be conducted on D+5.

c. SEALIFT ARABIAN (TAO-173) will conduct UNREP with ARG south of Sri Lanka.

5. COMMAND AND SIGNAL:

a. Communications IAW NWP-4 and COMMPLAN ANNEX D.
b. CTG 70.5 embarked VINSON, second in command is CTG 70.5.1 embarked BAINBRIDGE
c. Forces in direct support of CTG 70.5
   (1) CTU 72.5.8 provides EP-3 support
   (2) TG 72.8 provides P-3C support
   (3) TG 73.5 provides logistic support
   (4) TG 74.7 provides submarine support
   (5) USCINCPAC provides B-52G support
   (6) CIOTF provides E-3A AWACS support

ACKNOWLEDGE INSTRUCTIONS. Force commanders in Task Organization obtain acknowledgement receipts of this ORDER by administrative commanders assigned and acknowledge by message using message number.

Admiral Charles Fleischman
Commander TG 70.5

ANNEXES
A - Task Organization
B - Concept of Operations
C - Intelligence
D - Communications Plan

Copy No. 15 of 22
Pacific Fleet Force
USS VINSON (CVN-70) Flagship
DTG: 091200G FEB 1988

OPERATION ORDER
Commander Task Group 70.5 No. 1-88

ANNEX A

TASK ORGANIZATION

REF: A. COMSEVENTHFLT NO. 7-88
B. NWP - 7
C. NWP - 11
D. COMMANDER'S ESTIMATE CTG 70.5

Time Zone: Use time Zone GOLF for operations.

Copy No. 15 of 21
Pacific Fleet Force
USS VINSON (CVN-70) Flagship
DTG: 091200G FEB 1988

OPERATION ORDER
Commander Task Group 70.5 No. 1-88

ANNEX B

CONCEPT OF OPERATIONS

REF: A. COMSEVENTHFLT NO. 7-88
B. NWP - 7
C. NWP - 11
D. COMMANDER'S ESTIMATE CTG 70.5

Time Zone: Use time Zone GOLF for operations.

1. GENERAL CONCEPT OF OPERATIONS

a. This operation will be conducted in 5 phases as follows:
1- Destroy Soviet Intelligence gathering ships and aircraft.
2- Breakout of 70.7 combatants and movement of of ARG ALPHA (TG 76.3) and MPS (TG 73.3).
3- WAS strike against Soviet SAG.
4- Land strike against Soviet forward bases.
5- Preparation to move out of IO into Pacific.

b. The operation will commence at 151900Z ~~151200Z~~ Feb 1988 with a P-3C attack against the Moma AGI vicinity of Diego Garcia. At 151300Z Feb 1988 elements of TG 70.7 will begin transiting the Strait of Hormuz and ARG ALPHA TG 76.3 will begin movement. MPS TG 73.3 will move at 151800Z Feb 1988 to a MODLOC vicinity of Diego Garcia until rendezvous with USS LEFTWICH. Upon rendezvous MPS with LEFTWICH will depart for the Pacific Theater. On or about 152100G Feb 1988 a coordinated war at sea strike (if locating data available) using B-52G and CVBG aircraft will be conducted against the Soviet SAG. Once the Soviet SAG has been destroyed TG 70.5 will conduct a coordinated land strike against Soviet forward bases using both B-52Gs and CVBG aircraft. The TG will then conduct a UNREP prior to departing for the Pacific Theater.

2. ANTI-AIR WARFARE

a. USS Vinson will move south to be in position 18N/64E ("ZZ") to allow TG 70.5 to strike Kiev SAG while maintaining optimum AAW distance for self defense from both landbased and shipborne AAW threats. TG 70.7 ships will provide own force AAW protection until exit from the Gulf of Oman. TG 70.7 AAW sector extends clockwise from 300 degrees relative from TG 70.7 to a line of bearing intercepting Pakistan-Indian border. Saudi Arabian-based AWACS will be tasked to provide AEW to TG 70.7.

b. TG 70.5 AAW sectors are centered on ZZ as follows: Sector A - 000-090; Sector B - 090-180; Sector C - 180-270; Sector D - 270-000. Sector assignments: Bainbridge - Sectors A/B; Texas - Sectors C/D. Upon arrival of TG 70.7, Klakring will take Sector B and Barney will take Sector C. CGN's to continue coverage of Sectors D/A as previously assigned. Antrim will detach from TG 70.7 and assume silent Sam station at 25N/63E.

c. One F-14 will be assigned to Cap Sta One (330/300) and one to Cap Sta Two (030/300) under E-2C control. Each F-14 will remain on Cap Sta for 0+45 with relief on station. Fighters will top off from KC-135 at Sta "Texaco" (000/150 at FL 200) enroute to station. If KC-135 unavail, force will set single plane chainsaw patterns between ZZ and 330/450 ("Chainsaw One") and 030/450 ("Chainsaw Two"). Under either option, E-2C will be stationed 000/100-200. Loadout will be: 2 X AIM-54
2 X AIM-9
4 X AIM-7

d. AR set AAW alert as follows:

2 X F-14	Alert 5
2 X F-14	Alert 15
1 X KA-6	Alert 30

e. Four Strike Cap F-14's (two TARPS) will support WAS strike and provide BDA. Weapons loadout same as above.

3. ANTI-SURFACE WARFARE.

a. At H hour conduct coordinated B-52 and CVBG war at sea strike on Kiev SAG.
(1) Tentative H hour is 152100G
(2) Strike to be launched ASAP if Soviet CVBG approaches closer than 350 NM from CV
(3) National sensors, CVBG EA-3, and theater based EP-3 (if AAW threat allows) to locate, target and identify

individual units of Soviet SAG and neutral units in area.

(4) One P-3, two A-6E's and one S-3 required to locate and track Soviet SAG. All aircraft to remain outside of SAM envelope

(5) Priority of attack:
- (a) Kiev CVHG
- (b) Sovremennyy DDG
- (c) Kara CG
- (d) Krivak I FFG
- (e) Boris Chilikin AO

(6) Two B-52 launch from Diego Garcia at H minus three hours with full harpoon load

(7) CV based strike force to launch at H minus one point five hours

(8) CV strike to consist of:
- (a) Four F-14 strike cap. Two F-14 to be TARPS equipped.
- (b) Four A-6 with four harpoon each
- (c) Four A-7 with Harm/Shrike
- (d) Two EA-6B
- (e) One E-2C (Second E-2C already airborne conducting SSC)
- (f) Two A-6 with Sampson Decoys
- (g) Two S-3 with Sampson Decoys

(9) Strikes to be conducted as follows:
- (a) At H minus five minutes, deception group (Sampson equipped A-6 and S-3) pop up bearing 080 30 NM from the Soviet SAG. Aircraft launch decoys at 30-35 NM and turn outbound. Deception group not to enter Soviet Sam envelope.
- (b) At H minus three minutes A-7 and EA-6B aircraft pop up outside of SAM envelope to suppress SAMS
- (c) At H hour A-6 aircraft launch harpoon at 000 true 30 NM from the Soviet SAG.
- (d) At H minus two minutes B-52 aircraft launch harpoon at Soviet SAG as follows: one launches bearing 180 true 40 NM from SAG; one launches at 235 true 40 NM from the SAG.
- (e) One E-2C will control the A-6 attack group; one E-2C to control the deception group, strikecap and provide final attack vectors to the B-52. Goal is to gain certain mission kill on all units; secondary goal is to gain mobility kill on all units.

b. At 150800G one sub (USS OMAHA) to proceed to intercept Soviet SAG from behind. Proceed at best speed that will allow OMAHA to remain covert. Purpose is to cut off Soviet SAG from primary avenue of retreat.

c. Attack Soviet AGI and Mod Kashin

(1) At 150800G two P-3C aircraft with two harpoon each will launch from Diego Garcia. One P-3 will attack

Soviet AGI located in the vicinity of Diego Garcia with one harpoon to gain a mission kill. P-3's then to conduct surface recon of the Diego Garcia area with the primary objective of locating and attacking the Mod Kashin with harpoon.

d. Conduct B-52 and CVBG air strike on Aden.
   (1) Launch four B-52 aircraft from Diego Garcia to conduct low altitude bombing of airfield at Aden. CVBG aircraft provide SAM suppression, decoy, Electronic warfare and fighter support. Primary goal is to prevent Soviet aircraft from using runways; secondary goal is to destroy Aden based IL-38 May aircraft.
   (2) Desire aircraft to take off to permit 160430G time overhead Aden.

e. Conduct B-52 and CVBG air strike on Socotra.
   (1) Launch strike on Socotra in the same manner as Aden when timing allows.

f. Conduct B-52 and CVBG air strike on Dehalak.
   (1) Launch strike on Dehalak in the same manner as Aden when timing allows.

3. Anti-Submarine Warfare

a. ASWC will:
   (1) Coordinate ASW services with supporting forces including TG 72.8 (P3), TG 74.7 (sub), and ASW units with TG 73.3 (MPS) and TG 76.3 (ARG A) to ensure coherent ASW search and prosecution.
   (2) Conduct ASW IAW current OPGEN.

b. ASWC Threat Priorities
   (1) Echo II in South Bay of Bengal. This element straddles SLOC routes of TG's 73.2, 76.3, and 70.5 as they transit East and potentially possesses the most potent weapon system (SS-N-12) for use against our forces.
   (2) Charlie I, based on last date of 120400 has potential to be East of Socotra Island and poses a threat to TG 70.5.
   (3) Kilo is probably operating in the Gulf of Aden. low priority.

c. ASWC Tasks:
   (1) USS Omaha remains in position and conducts barrier operations in the Gulf of Aden in conjunction with USS San Francisco. If prosecution of all Soviet submarines in the area complete proceed towards Soviet SAG to cut off retreat.
   (2) USS San Francisco relocates to North of Socotra Island and search for Charlie I SSN threat in conjunction with USS Omaha.
   (3) P-3's from Diego Garcia will support AFS and AOE and conduct search operations for Echo II. P-3's from

Masirah will support ARG A.

(4) Position USS Cook and USS Fanning 50 NM in van of TG 70.5. One ship on the Echo II threat axis and one on the Charlie I axis.

(5) Use TG 70.5 organic S-3/A-3/H-2 will provide TG ASW and delousing.

d. ROE-Recommended Change--Destroy any submarines not positively visually ID'ed within 15 NM of US Forces.

4. CONTROL OF ELECTROMAGNETIC EMISSIONS

a. Electronic silence will be imposed on signals by CTG 70.5. To preclude detection, support OPDEC efforts and deny enemy targeting, strict adherence to EMCON condition is required.

b. Based upon the concept of operations and assumed TACSIT II posture, EMCON Alpha (WGD EMCON Plan 2B) is set. CTG 70.5/AE will modify EMCON condition, IAW Table 1, based upon changes in tactical situations.

c. Restrictions on battle group unique emitters-- the SPS-39 on USS Barney and the SPG-55 on USS Bainbridge will not radiate without authorization from AE.

d. Aircraft are authorized to use airborne search radars outside 50NM from ZZ.

TABLE 1

BGE EMCON PLAN	WGD EMCON PLAN	LNG RNG AIR SRCH RADAR	MED RNG AIR SRCH RADAR, FC RDR	SURF SRCH RDR	E S M	AIR BORN SRCH	SONR PASS	SONR ACT	UHF VCE	UHF SAT COM
A	2B				ON		ON			ON
B	1B +UHF SATCOM				ON	ON	ON		ON	ON
C	1D			ON	ON	ON	ON		ON	ON
C1	1D +ACTIVE SONAR			ON	ON	ON	ON	ON	ON	ON
D	3F	ON	ON	ON	ON	ON	ON	ON	ON	ON

5. AIR RESOURCES COORDINATOR.

a. AREC will provide all assets required by other warfare commanders whenever possible. Conflicts between warfare commanders must be settled between themselves before taskin AREC. ANy unresolved conflicts will be passed to Alpha Bra for decision.
b. Tasking must be received by 1600 local to ensure its inclus in the next day's flight plan.
c. All requested alerts will be launched ASAP if conditions permit. If unable to launch notification and estimate of launch time will be passed.
d. Appendix A provides airplan and loadplan information.
e. Appendix B provides the current and forecasted weather.

6. BATTLE FORCE LOGISTICS COORDINATOR.

a. CAMDEN (AOE-2), currently steering towards Diego Garcia whe overtaken by USS Leftwich (DD-984) steam in company to meet NIAGARA FALLS (AFS-3) and MISPILLION (TAO-105) for CONSOL. Upon completion of CONSOL, LEFTWICH will escort MISPILLION back to Diego Garcia. CAMDEN and NIAGARA FALLS sail in company to TG 70.5.
b. SIERRA (AD-18) will sortie, along with the MPS, to MODLOC Diego Garcia.

APPENDIXES:
A - CVBG AIRPLAN
B - WEATHER

ANNEX A (Task Organization) Operations Order

Reference:

Zone Time:

Task Organization:

a.	**CTG 70.5**	**USS VINSON (CVN-70)(F)**	**LCDR F**
			1 CVN
b.	**CTU 70.5.1**	**AAW UNIT**	**LCDR K**
		USS BAINBRIDGE (CGN-25)	1 CVN
		USS TEXAS (CGN-39)	2 CGN
		USS KLAKRING (FFG-42)	2 FFG
		USS BARNEY (DDG-6)	1 DDG
		USS VINSON (CVN-70)	
		USS ANTRIM (FFG-20)	
c.	**CTU 70.5.2**	**ASUW UNIT**	**MAJ C**
		USS KLAKRING (FFG-42)	2 FFG
		USS BARNEY (DDG-6)	1 DDG
		USS ANTRIM (FFG-20)	1 DD
		USS C. D. GRASSE (DD-974)	2 FF
		USS COOK (FF-1083)	2 CGN
		USS FANNING (FF-1076)	1 SSN
		USS BAINBRIDGE (CGN-25)	
		USS TEXAS (CGN-39)	
		USS OMAHA (SSN-692)	
d.	**CTU 70.5.3**	**ASW UNIT**	**MAJ K**
		USS COOK (FF-1083)	2 FF
		USS FANNING (FF-1076)	1 DD
		USS C. D. GRASSE (DD-974)	1 SSN
		USS SAN FRANCISCO (SSN 711)	
e.	**MPS**	**USS LEFTWICH (DD-984)**	
			1 DD

CWC ASSIGNMENTS

Primary	Alternate	Assigned	Location
AB	AC	LCDR C. A. Fleischmann, USN, CTG 70.5 MAJ R. R. KOURY, USA, CHIEF OF STAFF LCDR R. H. MAURER, USN	USS VINSON (CVN-70)(F)
AR		LCDR M. D. MOORE, USN, CTU 70.5.5	
AW	AB	LCDR E. C. KITTEL, USN, CTU 70.5.1 LCDR T. J. BRENNAN, USN	USS BAINBRIDGE
AE		LCDR G. M. TECCO, USN, CTU 70.5.4	(CGN-25)
AS	AZ	MAJ R. S. CHRIST, USAF, CTU 70.5.2 MAJ A. C. FELDER III, USMC LCDR D. J. FONTAINE, USN LCDR D. GRAY, USN	USS ~~KLAK-RING~~ (FFG-42)
AX	AT	MAJ M. J. KNOWLES, USMC, CTU 70.5.3 LCDR E. K. THOMPSON, USN MAJ P. C. TOPALIAN, USA	USS COOK (FF-1083)

Intel

LOGISTICS COORDINATOR	MAJ A. C. FELDER III, USMC	FFG-42
COMMUNICATIONS	LCDR D. GRAY, USN	FFG-42

SHIP/BASE	ACFTTYPE	NBR	LAUNCH	MISSION	REMARKS
VINSON	F-14	1	0800	CAP	STA 030/300
	F-14	1	0800	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	0800	TANKER	000/200
	A-6	1	0800	SSC	240/200
	A-6	1	0800	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	0800	AEW	000/150
	SH-3	1	0800	ASW/PG	090/005
	S-3	1	0800	ASW	180/100
	S-3	1	0800	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	
	EA-3A	1	0800	SSC	220/250
VINSON	F-14	2	0845	Launched only if needed	
VINSON	F-14	1	0930	CAP	STA 030/300
	F-14	1	0930	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	0930	TANKER	000/200
	A-6	1	0930	SSC	240/200
	A-6	1	0930	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	SH-3	1	0930	ASW/PG	090/005
	EA-6B	1	ALERT 30	ASMD	
VINSON	F-14	2	1015	Launched only if needed	
VINSON	F-14	1	1100	CAP	STA 030/300
	F-14	1	1100	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	1100	TANKER	000/200
	A-6	1	1100	SSC	240/200
	A-6	1	1100	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	1100	AEW	000/150
	SH-3	1	1100	ASW/PG	090/005
	S-3	1	1100	ASW	180/100
	S-3	1	1100	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	
VINSON	F-14	2	1145	Launched only if needed	

VINSON	F-14	1	1230	CAP	STA 030/300
	F-14	1	1230	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	1230	TANKER	000/200
	A-6	1	1230	SSC	240/200
	A-6	1	1230	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	1230	AEW	000/150
	SH-3	1	1230	ASW/PG	090/005
	S-3	1	1230	ASW	180/100
	S-3	1	1230	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	
	EA-3A	1	1230	SSC	220/250
VINSON	F-14	2	1315	Launched only if needed	
VINSON	F-14	1	1400	CAP	STA 030/300
	F-14	1	1400	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	1400	TANKER	000/200
	A-6	1	1400	SSC	240/200
	A-6	1	1400	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	1400	AEW	000/150
	SH-3	1	1400	ASW/PG	090/005
	S-3	1	1400	ASW	180/100
	S-3	1	1400	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	
VINSON	F-14	2	1445	Launched only if needed	
VINSON	F-14	1	1530	CAP	STA 030/300
	F-14	1	1530	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	1530	TANKER	000/200
	A-6	1	1530	SSC	240/200
	A-6	1	1530	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	1530	AEW	000/150
	SH-3	1	1530	ASW/PG	090/005
	S-3	1	1530	ASW	180/100
	S-3	1	1530	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	

VINSON	F-14	2	1615	Launched only if needed	
VINSON	F-14	1	1700	CAP	STA 030/300
	F-14	1	1700	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	1700	TANKER	000/200
	A-6	1	1700	SSC	240/200
	A-6	1	1700	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	1700	AEW	000/150
	SH-3	1	1700	ASW/PG	090/005
	S-3	1	1700	ASW	180/100
	S-3	1	1700	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	
	EA-3A	1	1700	AEW	000/200
VINSON	F-14	2	1745	Launched only if needed	
VINSON	F-14	1	1830	CAP	STA 030/300
	F-14	1	1830	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	1830	TANKER	000/200
	A-6	1	1830	SSC	240/200
	A-6	1	1830	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	1830	AEW	000/150
	SH-3	1	1830	ASW/PG	090/005
	S-3	1	1830	ASW	180/100
	S-3	1	1830	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	
VINSON	F-14	2	1915	Launched only if needed	
VINSON	F-14	1	2000	CAP	STA 030/300
	F-14	1	2000	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	2000	TANKER	000/200
	A-6	1	2000	SSC	240/200
	A-6	1	2000	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	2000	AEW	000/150
	SH-3	1	2000	ASW/PG	090/005
	S-3	1	2000	ASW	180/100
	S-3	1	2000	SSC	220/300

	EA-6B	1	ALERT 30	ASMD	
VINSON	F-14	2	2045	Launched only if needed	
VINSON	F-14	1	2130	CAP	STA 030/300
	F-14	1	2130	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	2130	TANKER	000/200
	A-6	1	2130	SSC	240/200
	A-6	1	2130	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	2130	AEW	000/150
	SH-3	1	2130	ASW/PG	090/005
	S-3	1	2130	ASW	180/100
	S-3	1	2130	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	
	EA-3A	1	2130	SSC	220/250
VINSON	F-14	2	2215	Launched only if needed	
VINSON	F-14	1	2300	CAP	STA 030/300
	F-14	1	2300	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	2300	TANKER	000/200
	A-6	1	2300	SSC	240/200
	A-6	1	2300	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	2300	AEW	000/150
	SH-3	1	2300	ASW/PG	090/005
	S-3	1	2300	ASW	180/100
	S-3	1	2300	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	
VINSON	F-14	2	2345	Launched only if needed	
VINSON	F-14	1	0030	CAP	STA 030/300
	F-14	1	0030	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	0030	TANKER	000/200
	A-6	1	0030	SSC	240/200
	A-6	1	0030	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	0030	AEW	000/150
	SH-3	1	0030	ASW/PG	090/005

	S-3	1	0030	ASW	180/100
	S-3	1	0030	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	
VINSON	F-14	2	0115	Launched only if needed	
VINSON	F-14	1	0200	CAP	STA 030/300
	F-14	1	0200	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	0200	TANKER	000/200
	A-6	1	0200	SSC	240/200
	A-6	1	0200	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	0200	AEW	000/150
	SH-3	1	0200	ASW/PG	090/005
	S-3	1	0200	ASW	180/100
	S-3	1	0200	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	
	EA-3A	1	0200	SSC	220/250
VINSON	F-14	2	0245	Launched only if needed	
VINSON	F-14	1	0330	CAP	STA 030/300
	F-14	1	0330	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	0330	TANKER	000/200
	A-6	1	0330	SSC	240/200
	A-6	1	0330	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	0330	AEW	000/150
	SH-3	1	0330	ASW/PG	090/005
	S-3	1	0330	ASW	180/100
	S-3	1	0330	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	
VINSON	F-14	2	0415	Launched only if needed	
VINSON	F-14	1	0500	CAP	STA 030/300
	F-14	1	0500	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	

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USS VINSON (CVN-70) Flagship
DTG: 091200G FEB 1988

OPERATION ORDER
Commander Task Group 70.5 No. 1-88

APPENDIX A

CVBG AIR AND LOAD PLAN

REF: A. COMSEVENTHFLT NO. 7-88
B. NWP - 7
C. NWP - 11
D. COMMANDER'S ESTIMATE CTG 70.5

Time Zone: Use time Zone GOLF for operations.

	KA-6D	1	0500	TANKER	000/200
	A-6	1	0500	SSC	240/200
	A-6	1	0500	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	0500	AEW	000/150
	SH-3	1	0500	ASW/PG	090/005
	S-3	1	0500	ASW	180/100
	S-3	1	0500	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	
	EA-3A	1	0500	AEW	000/200
VINSON	F-14	2	0545	Launched only if needed	
VINSON	F-14	1	0630	CAP	STA 030/300
	F-14	1	0630	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	0630	TANKER	000/200
	A-6	1	0630	SSC	240/200
	A-6	1	0630	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	0630	AEW	000/150
	SH-3	1	0630	ASW/PG	090/005
	S-3	1	0630	ASW	180/100
	S-3	1	0630	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	
VINSON	F-14	2	0715	Launched only if needed	
VINSON	F-14	1	0800	CAP	STA 030/300
	F-14	1	0800	CAP	STA 330/300
	F-14	2	ALERT 5	CAP	TBA
	F-14	2	ALERT 15	CAP	TBA
	A-7	2	ALERT 30	SUCAP	
	KA-6D	1	0800	TANKER	000/200
	A-6	1	0800	SSC	240/200
	A-6	1	0800	SSC	200/200
	A-6	2	ALERT 30	SUCAP	
	E-2	1	0800	AEW	000/150
	SH-3	1	0800	ASW/PG	090/005
	S-3	1	0800	ASW	180/100
	S-3	1	0800	SSC	220/300
	EA-6B	1	ALERT 30	ASMD	

CV strike to consist of:

(a) Four F-14 strike cap. Two F-14 to be TARPS equipped.
(b) Four A-6 with four harpoon each
(c) Four A-7 with Harm/Shrike
(d) Two EA-6B
(e) One E-2C (Second E-2C already airborne conducting SSC)
(f) Two A-6 with Sampson Decoys

(g) Two S-3 with Sampson Decoys

F-14 loadout will be:	2 X AIM-54	2 X AIM-9	4 X AIM-7
AAW alert as follows:	2 X F-14	Alert 5	
	2 X F-14	Alert 15	
	1 X KA-6	Alert 30	
ASUW Alert as follows	2 X A-7	ALERT 30	2Hrm/2Shrike
	2 X A-6	Alert 30	2 Harpoon
			2 Rockeye
ASW Alert as follows	~~2~~ X S-3	Alert 30	1/MK46
	1 X H-2	alert 5	2 MK 46

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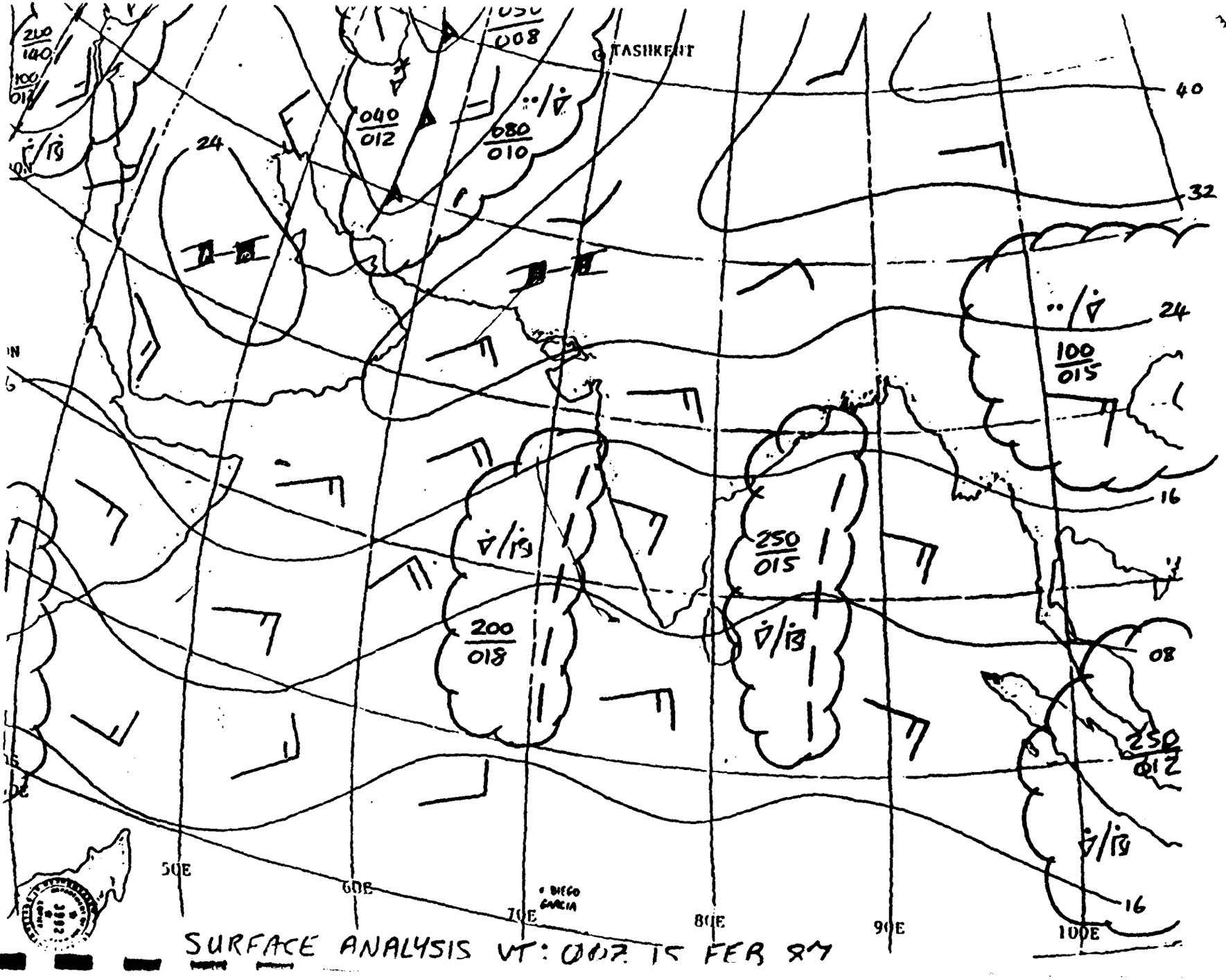
APPENDIX B

WEATHER

REF: A. COMSEVENTHFLT NO. 7-88
B. NWP - 7
C. NWP - 11
D. COMMANDER'S ESTIMATE CTG 70.5

Time Zone: Use time Zone GOLF for operations.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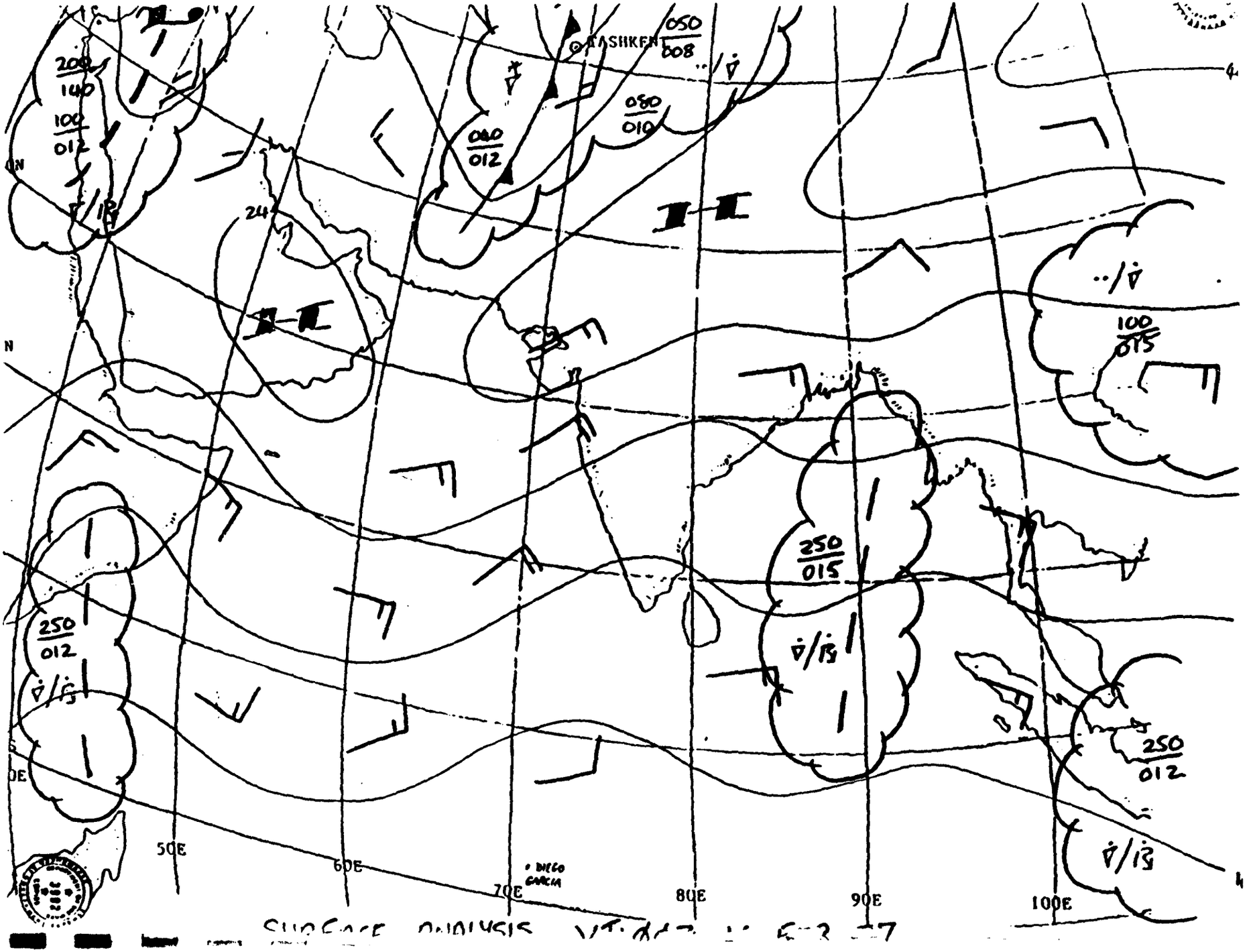
050/008
680/010
210/140
100/015
250/015
200/018
250/012
24
32
40
16
08
50E
60E
70E
80E
90E
100E
DIEGO GARCIA
SURFACE ANALYSIS VT: 00Z 15 FEB 97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080
012
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140
100
012
100
015
250
015
250
012
250
012
DIEGO GARCIA
50E
60E
70E
80E
90E
100E
N

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ANNEX C

INTELLIGENCE

REF: A. COMSEVENTHFLT NO. 7-88
B. NWP - 7
C. NWP - 11
D. COMMANDER'S ESTIMATE CTG 70.5

Time Zone: Use time zone GOLF for operations.

Intelligence Update 1
(as of 150400z)

1. Enemy Forces

Type	Location
Soviet SAG Kiev CVHG Kara CG Sovremenyy DDG Krivak I FFG Chilikin AOR	12N/58E vic Socotra Is
MOD Kashin	Unk E of Madagascar at Mauritius
Soviet Resupply Grp Petya FFL Mayak AF Ingul ARS Lama AEM Amur AR Don AS	Dahalak Is in Red Sea
Soviet Resupply Grp Yug AGOR Mer TUG Moma AGS 4 X May (Maritime Surv) 1 X Candid (Transport)	Aden
SNA Regiment 22 X Backfires 4 X Bear D (Recon) 6 X Bear A (Bomber)	Tashkent
Moma AGI	Diego Garcia
SS Force Kilo SS	Unk vic Red Sea entrance 110400z
Charlie I SSGN	Unk vic Aden 120400z
Foxtrot SS	Unk Dahalak Is 130400z
Echo II SSGN	Unk 4N/63E 110400z

2. Enemy Capabilities:

Includes the ability to attack Task Force Echo, the ARG, and the MPS with air, surface and subsurface vessels while continuing to occupy the Red Sea SLOC with its support fleet.

Most likey capabilities include 4 possible tentatively identified options:

A. Strike with Backfire bombers from Tashkent against the AGR, Task Force Echo, and COMMIDEASTFOR located in the Persian Gulf with or without subsurface support leaving the SAG to defend the SLOC and entrance to the Red Sea.

B. Proceed against the ARG with the SAG before our escourts arrive, after which it can transit to Diego Garcia to destroy the MPS and engage our forces.

C. Proceed against Diego Garcia and the MPS and our forces after which it can transit to destroy the ARG.

D. Continue to defend the Soviet resupply bases at Adan and Dehalak with the SAG effectively cutting off the Red Sea and Suez SLOC.

Order of Battle

SURFACE COMBATANTS

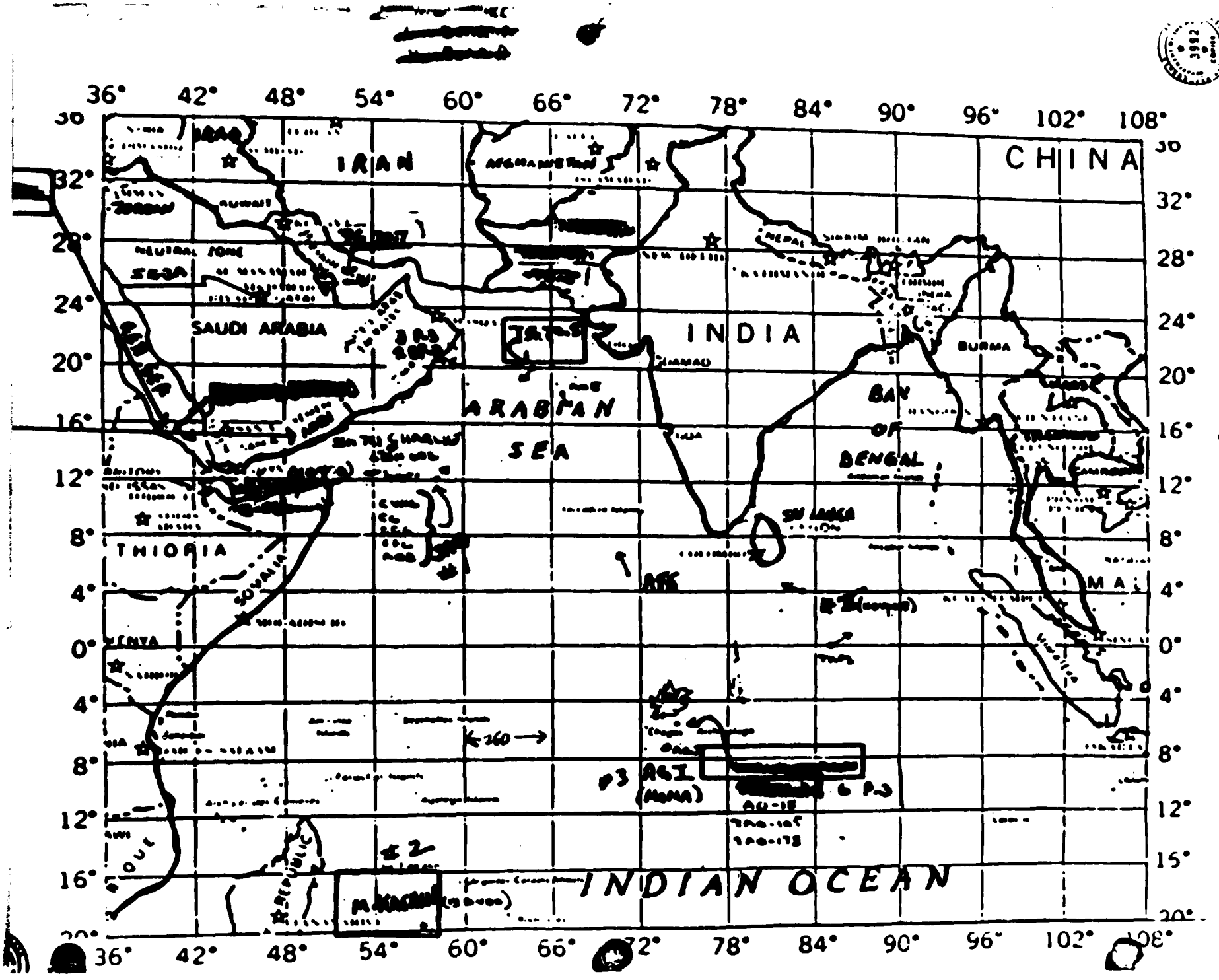
KIEV CVHG	SS-N-12 (550 KM) SA-N-3 (MED) SA-N-4 (LOW) FORGERS VSTOL HORMONES (TGTING) 250 KM RAD HELIX (ASW/300KM , RAD)
KARA CG	SS-N-14 (50 KM) SA-N-3 (MED) SA-N-4 (LOW) HORMONE (TGTING/ 250 KM RAD) HELIX (ASW/300KM RAD)
SOVREMENYY DDG	SS-N-22 (100) SA-N-7 (MED-LOW) HORMONE (TGTING) 250 KM RAD HELIX (ASW) 300 KM RAD
KRIVAK FFG	SS-N-14 (50 KM) SA-N-4 (LOW)
MOD KASHIN	SS-N-2 (100 KM) SA-N-1 (LOW-MED)
MAYAK AF	SA-N-5 (LOW)

SUBSURFACE

KILO SS	TORPEDO/MINES
FOXTROT SS	TORPEDO/MINES
CHARLIES SSGN	SS-N-7 (80 KM)
ECHO II SSGN	SS-N-12 (550 KM) OR SS-N-3 (400 KM)

AIRCRAFT

BACKFIRE (Unrefueled 4000km rad) (Inflight refuelable)	Probably AS-4
BEAR A (Unrefuelded 8000km rad)	Bombs
BEAR D "	RECON
MAY	Maritime ASW/Recon



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DTG: 091200G FEB 1988

OPERATION ORDER
Commander Task Group 70.5 No. 1-88

ANNEX D

COMMUNICATIONS PLAN

REF: A. COMSEVENTHFLT NO. 7-88
B. NWP - 7
C. NWP - 11
D. COMMANDER'S ESTIMATE CTG 70.5

Time Zone: Use time Zone GOLF for operations.

WARGAME COMMUNICATION PLAN

GAME A

VOICE CIRCUITS

PLAYER (CMD CTR)	UMP						
HIGHER AUTHORITY	TRG NO	Aircraft 22	Forces	[illegible]	[illegible]	[illegible]	[illegible]
AG/AE (1)		A	B				B
RS/RR (2)	11		B	C			B
RX/SEC (3)	10		B		C		B
AW (4)	14		B			C	B

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	A	B		D
[illegible]		B	C	D
[illegible]		B	C	D
[illegible]		B	C	D

11/8/88

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